West Eugene Wetlands Mitigation Bank

Annual Report - 2002

This report was prepared by the Parks and Open Space Division
of the City of Eugene's Public Works Department

March 2003

For additional information about the Mitigation Bank Program, contact:

Dal Ollek
Mitigation Bank Coordinator
City of Eugene
Parks and Open Space Division
1820 Roosevelt Blvd.
Eugene, OR 97402
Phone: (541) 682-4928

or

Eric Wold
Wetlands Program Supervisor
City of Eugene
Parks and Open Space Division
1820 Roosevelt Blvd.
Eugene, OR 97402
Phone: (541) 682-4888

This report is available on the internet at: **http://www.ci.eugene.or.us/wewetlands/Mitgn_Rpt/rpt2002.htm**

Table of Contents

Chapter 1: Introduction

Background

The West Eugene Wetland Mitigation Bank Program operates under an agreement between the Oregon Division of State Lands, Oregon Department of Environmental Quality, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Bureau of Land Management, and the City of Eugene. The Memorandum of Agreement (MOA) establishing the Bank was signed in 1995.

This is the seventh annual report required as a condition of the MOA that established the West Eugene Wetland Mitigation Bank (Bank). This annual report serves two primary purposes:

1. To fulfill the technical reporting requirements identified in the MOA.
2. To provide a broader view of the Bank's operations and accomplishments for a general audience who view the Bank as a model project in Oregon and the United States.

Organization of this report

This report is organized into two main parts with an introduction:

Chapter 1: Introduction. This chapter provides an overview of the mitigation bank program and this annual report.

Part 1: Financial and Planning Information

Chapter 2: Credit and Financial Summary. This chapter describes the financial status of the Bank. Information on credit sales, credit generation, Bank expenditures, and a financial reconciliation are included.

Chapter 3: Capital Improvement Plan. This chapter presents the Bank's proposed future projects, from 2003 through 2006.

Chapter 4: **Seed Procurement Program**. This chapter describes the seed procurement activities of the Bank.

Part 2: Site reports

Chapter 5: Introduction to Site Reports. This chapter contains an overview of the information contained in the site reports. It also presents the structure for the reports.

Chapters 6 - 14: Site reports. These chapters include information on individual mitigation bank sites including: background, design goals, management actions from the previous year, and recommended actions for 2003. The monitoring reports are also included.

Appendices:

A - Monitoring Methods. This section is a description of the data collection methods employed to obtain data used in the monitoring reports.

B - Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

C - Rainfall Graph. This graph shows monthly rainfall totals for the Eugene Airport during 2001-2002 compared to the mean and standard deviation of monthly rainfall between 1940 and 2002.

A brief overview of wetland regulation and planning

Wetlands are regulated by a combination of Federal, State, and local regulations. At the Federal level, wetlands are regulated by U.S. Army Corps of Engineers under the Clean Water Act and the Rivers and Harbors Act, as well as by the U.S. Natural Resources Conservation Service under the federal Farm Bill. At the State level, wetlands are regulated by the Oregon Division of State Lands under the State Removal-Fill Law. At the local level, wetlands are also regulated by the West Eugene Wetlands Plan, Oregon's first Wetland Conservation Plan. The West Eugene Wetlands Plan (Plan) was originally adopted by the Eugene City Council and the Lane County Board of Commissioners in 1992, and then amended in 2000. The Plan is a multiple objectives planning document that provides a vision for wetland protection while accommodating development. The Plan policies call for creation of a mitigation bank to help fund restoration and enhancement. The West Eugene Wetlands Mitigation Bank was created to meet this need.

Mitigation bank program

Why a mitigation bank? The advantage of a mitigation bank is that mitigation actions are planned within the context of the wetland system where the most suitable sites are identified, acquired, and restored in advance of wetland impact. This strategy is preferred to the alternative that inevitably results in incremental and disconnected attempts at mitigation.

Why a public mitigation bank? The advantage of a public mitigation bank is that the functions and values that the wetland resource may provide are accessible to the community. Although use may be restricted, it is not prohibited. The public is able to utilize opportunities for recreation and education. The lands of the West Eugene Wetlands Program comprise the largest component of the open space system within the City's Urban Growth Boundary. Furthermore, the bank is managed by the City, which is held accountable by the community that it represents.

What is the West Eugene Wetland Mitigation Bank? The West Eugene Wetland Mitigation Bank program includes wetland restoration and enhancement on a number of suitable sites and the certification and sale of mitigation credits to applicants required to provide compensation for adverse impacts to wetland resources. Restoration sites are located within a connected system of existing wetlands that are managed by the West Eugene Wetlands Partnership. The Bank orchestrates the process of mitigation by providing compensatory mitigation in advance of approved impacts to wetlands. The Bank is a key instrument envisioned in the Plan to achieve three major objectives: (1) to lead in the implementation of plans to restore and enhance wetland communities, (2) to provide certified

compensatory mitigation credits to businesses and public agencies that seek to impact wetlands located within the Bank's service area, and (3) to provide an alternative to meet mitigation needs in a timely and economic manner

What are credits? A credit is a unit of measure representing the accrual or attainment of wetland functions at a mitigation bank. The unit of measure of function is typically indexed to the number of wetland acres that are restored, created, enhanced, or preserved. A "certified credit" results when the mitigation bank has met or exceeded the performance standards established in the Bank MOA. Once credits are certified, they are available for sale or exchange.

For more information on mitigation banks in Oregon, visit the Oregon Division of State Lands Wetlands Program web site.

Who are the players?

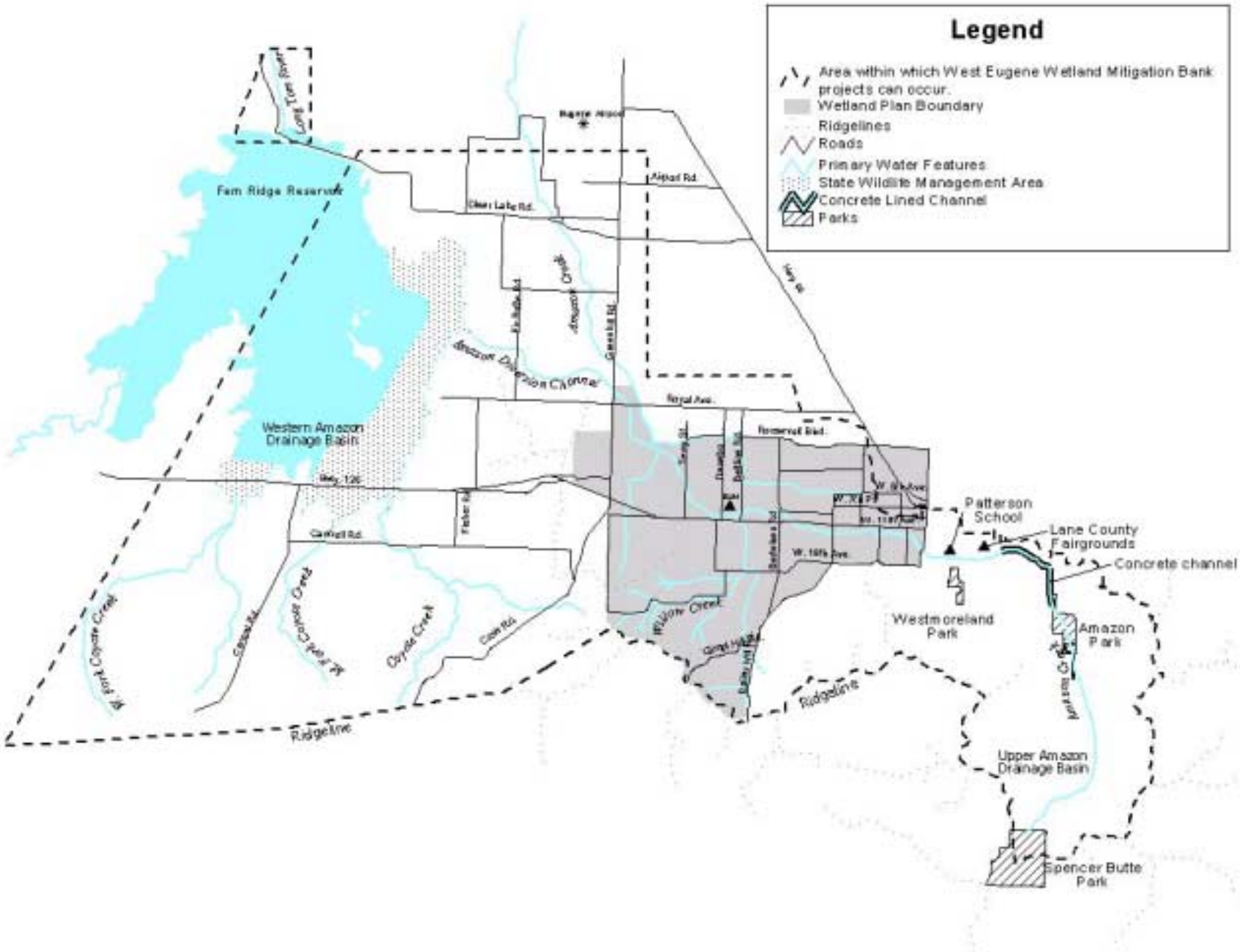
The City of Eugene is the Bank sponsor. Staff from the City of Eugene's Parks and Open Space Division, Wetlands and Open Waterways Section, manage Bank operations. The Bureau of Land Management (BLM) and The Nature Conservancy (TNC), as partners in the West Eugene Wetlands Program and as a cosigner to the Bank MOA (in the case of the BLM), provide technical assistance to develop monitoring protocols, to design restoration and enhancement projects, to construct Bank projects, and to contribute to the operation and management of the Bank.

State and federal agencies form a committee, the Mitigation Bank Review Team (MBRT), which oversees the Bank's operations. It is the responsibility of the MBRT to review and approve plans for wetland restoration and enhancement, to monitor Bank operations for compliance, and to provide technical assistance in Bank management when requested. The MBRT consists of representatives of three federal agencies (the U.S. Environmental Protection Agency, the Army Corps of Engineers, and the U.S. Fish & Wildlife Service) and two state agencies (the Oregon Division of State Lands and the Oregon Department of Environmental Quality).

Where can West Eugene Wetland Mitigation Bank projects occur?

Bank mitigation projects take place within the Long Tom River watershed, of which Amazon Creek is a tributary. Figure 1.1 shows the geographic area within which the mitigation bank operates. This area was originally identified on Map 2 of the West Eugene Wetlands Plan as the "Western Amazon Drainage Basin", and in Appendix C (Map 1) of the MOA that established the Bank.

Figure 1.1. Area within which West Eugene Wetland Mitigation Bank projects can occur.



Chapter 2: Credit and Financial Summary

Financial information for the 2002 calendar year is provided in this chapter. Included is:

1. Information regarding mitigation credit sales during 2002.
2. A list of pending bank customers and the number of credits expected in the transactions.
3. A list of annual Bank credit sales from 1994 – 2002.
4. A summary of Bank revenues and expenses.

Credit sales during 2002

At the beginning of the calendar year, the Bank had a credit balance of 8.28 credits. The Bank sold a total of 7.73 mitigation credits during 2002 to a combination of private and public organizations, leaving an end-of-year balance of 0.55 credits. In December, the Bank also submitted a request to get an additional 13.79 credits certified. This request for certified credits is expected to be approved in January 2003, and would leave a balance of 14.34 credits. Please refer to Table 2.1 below, for a more detailed view of the credits sales.

Table 2.1. Summary of credit sales during 2002.

	Purchase Date	Credits in Transaction	Balance
Credit balance on January 1, 2002			**8.28**
Credits sold in 2002			
Springfield Utility Board (SUB): Water Treatment Facility	Jan. 2002	<0.01>	8.27
Breeden Bros.: Somerset Hills VIII	Jan. 2002	<0.39>	7.88
Lane County: Prairie Road Project	Feb. 2002	<0.07>	7.81
Truck ‘N Travel	Apr. 2002	<0.06>	7.75
City of Springfield: Dairy Street Project	Apr. 2002	<0.10>	7.65
Madstein/Scientific Developments:	May 2002	<1.61>	6.04
City of Eugene: Royal Ave.	July 2002	<0.16>	5.88
Commercial Group NW LLC: Enid St.	Sept. 2002	<2.16>	3.72
Precision Machine & Mfg Inc.: 13th & Bertlesen	Sept. 2002	<0.18>	3.54
City of Creswell: Garden Park	Sept. 2002	<0.11>	3.43
Barger Development: Michael's Landing Subdivision	Sept. 2002	<2.66>	0.77
Lane County: Irvington Drive	Dec. 2002	<0.14>	0.63
Hiatt: Mimosa Subdivision, Spfld. OR	Dec. 2002	<0.08>	0.55
Subtotal of credits sold in 2002		**<7.73>**	
Credit balance as of December 31, 2002			**0.55**
Credits requested for certification on December 5, 2002		13.79	14.34
Balance forward after approval of credit request (expected in January 2003)			**14.34**

Pending credit sales

The pending sales list is an inclusive list of Bank customers who have indicated that they intend to utilize the Bank as for achieving their mitigation within the Joint Wetland Fill Permit Application. The pending sales list is not a waiting list. Customers are added to the pending sales list upon submittal of a letter of intent to use the bank. Wetland Fill Permit applicants are encouraged to notify the Bank of their intent to purchase credits from the Bank prior to submitting their application to the regulatory agencies. Once on the pending sales list, the Bank works with the applicant to ensure that the applicant has submitted all required information concerning the impact. In addition, this list is one of the tools used by the Bank to gauge the demand for credits. At the end of 2002, the Bank had pending requests for 12.51 credits (see Table 2.2).

Table 2.2. Pending credit sales.

	Purchase Date	**Credits in Transaction**	**Balance**
Balance forward after approval of credit request			**14.34**
Pending credits sales			
Lane County: Irvington Drive		<0.14>	
Curtis		<0.65>	
Alexander		<0.28>	
City of Eugene: Royal Ave. Trailhead		<1.33>	
Derrick Brown		<0.30>	
Eugene Airport		<9.81>	
Subtotal of credits pending		**<12.51>**	
Estimated credit balance if pending credit sales are completed			**1.83**

Annual Bank credit sales from 1994 - 2002

Since its first credits sale in 1994, the Mitigation Bank has sold a total of 64.53 compensatory mitigation credits. See Table 2.3 for an annual break-down of credit sales.

Table 2.3. Summary of Annual Credit Sales, 1994 – 2002

Calendar Year	**Total Credits Sold**
1994	7.29
1995	1.50
1996	2.71
1997	15.03
1998	9.66
1999	8.08
2000	5.13
2001	7.40
2002	7.73
Total	**64.53**

Financial summary

Table 2.4 summarizes the Bank's financial activity during 2002. The Bank started the calendar year with a cash balance of $836,603.83. Revenue from Credit Sales and other sources of income totaled $979,059.00. Operations and Maintenance costs totaled $96,284.14, while Capital Costs totaled $731,357.81. The end of year cash balance was $988,020.88 (Table 2.4).

Finally, in 2002, the Bank implemented an increase in the per-credit purchase price from $30,000 to $50,000.

Table 2.4. Financial summary for 2002.

Description of Item	Transaction Amt.	Balance
Cash balance - January 1, 2002		**836,603.83**
Revenue		
Credits Sold (7.65) at $30,000 per credit	229,500.00	
Credits Sold (0.08) at $50,000 per credit	4,000.00	
Dec 31, 2002 advance of 1.33 credits, at $50,000 per credit, for Royal Ave Trailhead Project	66,500.00	
OYCC Grant Funds	11,111.00	
NAWCA Grant Land Acquisition	525,000.00	
BLM - Native Seed Collection	13,860.00	
BLM - Botanical Technical Assistance - .25 FTE of the Nature Conservancy	10,000.00	
USAED - Lower Amazon Creek Restoration Project Native Seed & Plant Material	90,984.00	
Interest Income	28,104.00	
Subtotal of Revenues	**979,059.00**	
		1,815,662.83
Operations and Maintenance Costs		
WMB/OM Payroll and misc. operation expenses	72,687.35	
WMB/OM Dnbo/Wllw Crk Cnflnc	3,600.16	
WMB/OM Dnbo Wst: Balboa Phs I	2,317.05	
WMB/OM Dnbo Wst Bvr Rn Phs I	9,798.18	
WMB/OM Eastern Gateway	841.30	
WMB/OM Stewart Pond Complex	365.25	
WMB/OM Isblle St Mngmnt Unt	869.60	
WMB/OM N. Grnhll Cnst Phs I	1,350.96	
WMB/OM Nolan	2,210.38	
WMB/OM Greenhill Ash Grove	495.25	
WMB-BLM Reimbursement	1,578.08	
WMB/OM Beaver Run Ph II	170.58	
Subtotal of Operations and Maintenance Costs	**96,284.14**	
		1,719,378.69

Description of Item	Transaction Amt.	Balance
Capital Costs		
Willow Corner	19,877.82	
WMB - Danebo O & M	4,106.00	
WMB Unit 3 Lower Amazon	2,502.90	
NAWCA Grant Land Acq	525,000.00	
WMB Danebo Willow Crk Cnflnc	119.90	
WMB - Nolan	763.55	
WMB Danebo Wst: Bvr Rn Phs I	614.00	
WMB-Oxbow West	1,057.97	
WMB Turtle Swale	100,819.22	
WMB - North Greenhill Ph 2	9,866.09	
WMB-North Greenhill, Ph 3	122,472.15	
WMB-Seed Procurement Prog - Reimbursement	(56,036.01)	
WMB-Beaver Run Phase II - Reimubursement	(718.31)	
WMB Danebo Wst: Blboa Phs III	912.53	
Subtotal of Capital Costs	**731,357.81**	
Cash balance - December 31, 2002		**988,020.88**

Chapter 3: Capital Improvement Plan

This chapter contains a summary of the projected new mitigation bank projects for 2003 through 2005. The Capital Improvement Program for 2003 – 2005 is outlined in Table 3.1, below.

Table 3.1. Capital Improvement Program for 2003 – 2005.

Year	Project Name	Description of Actions[1]	Acres	Credits[2]
2003	Willow Corner	Re-establish the mosaic of wetland and upland prairie that existed on this site prior to deposition of fill. The project will primarily involve removal of fill material that had been placed on the site in preparation for development. The fill-removal will be followed by planting the site with a high diversity, native Willamette Valley wet prairie seed mix.	6.14	6.00
2003	Oxbow West	Enhance and restore native wet prairie and vernal pool communities where they are degraded. Control exotic and woody vegetation in the wetland and upland prairie through primarily mechanical means.	13.82	5.64
2003	Lower Amazon (Meadowlark Prairie), Unit 2, Phase 1	Utilize agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	26.25	0.00
2003	Dragonfly Bend	Develop a Mitigation Improvement Plan (MIP) for Dragonfly Bend.	68.00	0.00
2004	Dragonfly Bend, Phase 1	Implement the first phase of the Dragonfly Bend MIP.	20.00	12.00
2004	Lower Amazon (Meadowlark Prairie), Unit 2, Phase 1	Continue to use agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	26.25	0.00
2004	Turtle Swale, Phase 3	Utilize agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	8.00	0.00
2005	Lower Amazon (Meadowlark Prairie), Unit 2, Phase 1	Do final site preparation. Plant with high diversity, native Willamette Valley wet prairie seed mix.	26.25	15.00
2005	Turtle Swale, Phase 3	Do final site preparation. Plant with high diversity, native Willamette Valley wet prairie seed mix.	8.00	4.00

[1] For a full description of the planned actions, refer to the associated MIP

[2] The number of credits is estimated based on the approved MIP. The final number of certified credits is determined by as-built conditions and the subsequent approval by the DSL and the Corps. Credits are shown as 0.0 when the specific activity (e.g., doing initial site prep) shown in any one year does not actually generate credits.

Year	Project Name	Description of Actions[1]	Acres	Credits[2]
2005	Oxbow East (Willamette Daisy Meadow)	Utilize agricultural techniques such as disking and tilling, plus thermal weed control, to kill the existing non-native vegetation on the site.	5.07	0.00

Chapter 4: Seed Procurement Program

The West Eugene Wetlands Partnership's seed procurement program continues to build in its seventh season. The program, guided by the standards outlined in the partnership's *1996 Wetland Plant Supply Strategy* document, seeks to ensure the availability of native plant materials for restoration efforts within the West Eugene Wetlands study area. To minimize costs, our strategy has focused on collection and increase of seed stocks, rather than using labor-intensive and expensive container or bare root plantings. Seeds of most of our native wetland species are not available commercially, particularly seed of local origin that will allow us to maintain genetic integrity of local wetland plant communities. Thus, seed collection and nursery bed grow-out for seed increase are the major components of the procurement program. Additional research is ongoing, to help us to discover why we have limited success growing plants from the seeds of some species.

Seed is collected and processed by field staff, contract collectors, and youth crews. In 2002, seed was collected through the combined efforts of the BLM, the City, Lane Metro and Northwest Youth Corps crews, and volunteers. Over 116 pounds of seed from 65 species of native plants were collected by the combined effort. Seed cleaning equipment and techniques continued to be refined to improve seed processing efficiency; this ongoing learning is reflected in the development of an in-house Seed Collection Manual. Currently, the majority of the seed collected annually is used for the direct seeding of mitigated areas. Appropriate species (generally the most commonly encountered species) are selected for grow-out, then transported to contract nurseries and farmers, where seed quantity is magnified many times.

The U.S. Forest Service's J. Herbert Stone Nursery (Stone) in Jacksonville, Oregon has been growing out small seed quantities for the WEW Partnership since 1996. To date, Stone has attempted to grow approximately 45 species of native plants from the West Eugene Wetlands (Table 4.1). During 2002, Stone provided over 700 pounds of seed, representing 14 species of native plants used in the West Eugene Wetlands. Most of the seed that is produced at the nursery is seeded onto project mitigation sites. During the fall of 2002, Stone planted additional bed space of one uncommon species, *Juncus nevadensis*; they grew the seed into plugs, and then transplanted the seedlings out into the field bed.

Pacific Northwest Natives (PNN, Albany, Oregon) has successfully grown more than 9 species from the West Eugene area in larger plots, including: *Agrostis exerata, Beckmannia syzigachne, Danthonia californica, Deschampsia cespitosa*, *Elymus glaucus, Epilobium densiflorum, Hordeum brachyantherum, Lupinus rivularis,* and *Plagiobothrys figuratus*. During 2002, 18 lbs of *Danthonia californica* were purchased from PNN. All seed has gone through the Oregon State seed certification program, including germination and purity testing.

The USDA Plant Materials Center (PMC) in Corvallis studied germination of 21 species of West Eugene plants in 2002. Nineteen of those species germinated successfully. Seeds from 5 species were grown out under controlled conditions; the seed produced by those efforts were returned to the West Eugene Wetlands program. Other species were planted in the wetlands as plugs (see Table # below).

Seed of many species of plants were grown into seedlings (plugs) by students at the Rachel Carson Environmental Studies program at Churchill High School (10 species), by inmates at the Oregon State Correctional Institution (17 species), by PMC (5 species), and by Stone (2 species). Plugs were planted in the early spring and in the fall on a number of restoration sites, with the help of Lane Metro and

Northwest Youth Corps crews, as well as staff and volunteers. Twenty-one species of seedlings from the Oregon State Correctional Institution have been transferred to the Rachel Carson greenhouse for the spring 2003 growing season.

Success of fall plug planting will be assessed via an experiment to monitor survival of some of the plugs. Six species of plugs were placed into 48 plots at four restoration sites. Data on plug survival in these plots is being recorded monthly.

Additionally, about 700 mature *Camas leichtlinii* ssp. *suksdorfii* bulbs were dug up from Turtle Swale and replanted nearby. Over 1000 mature *Camassia quamash* ssp. *maxima*bulbs were dug up from private land (after the landowner received approval for a Fill Permit); the bulbs were replanted in the West Eugene Wetlands, as well as in about 17 other sites in the city of Eugene.

Table 4.1. Seed Increase and Plant Procurement. Each species that has been, or is currently, in grow-out is listed with its associated location of increase.

Species	Previously	Current Status			
	Grown at J.H. Stone Nursery	Seed from J.H. Stone Nursery	Seed from PNN	Seedlings growing in 2003 from OSCI	Research at PMC
Allium amplectens	X			X	X
Agrostis exarata	X		X		
Aster hallii	X	X			
Beckmania syzigachne	X		X		
Brodiea coronaria				X	X
Camassia leichtlinii ssp. suksdorfii	X			X	
Camassia quamash ssp. maxima	X			X	
Cardamine penduliflora					X
Carex densa	X	X			
Carex unilateralis	X	X			
Castilleja tenuis					X
Collomia grandiflora					B
Danthonia californica	X	X	X	X	
Deschampsia caespitosa	X		X	X	
Dichelostema congesta				X	
Downingia elegans	X				
Downingia yina	X				
Eleocharis ovata	X				
Elymus glaucus	X	X	X		
Epilobium densiflorum	X		X		
Eriophyllum lanatum	X	X		X	
Glyceria occidentalis	X		X		

Species	Previously	Current Status			
	Grown at J.H. Stone Nursery	Seed from J.H. Stone Nursery	Seed from PNN	Seedlings growing in 2003 from OSCI	Research at PMC
Gratiola ebracteata	X				
Grindelia integrifolia	X	X			
Hordeum brachyantherum	X		X		
Juncus acuminatus	X				
Juncus bolanderi	X			X	
Juncus ensifolius				X	
Juncus nevadensis	X	X		X	
Juncus oxymeris	X				
Juncus patens	X			X	
Juncus tenuis	X				
Lotus formosissimus	X				
Lupinus bicolor					B
Lupinus rivularis	X		X		
Lupinus polyphyllus	X			X	
Madia elegans	X			X	B
Microseris laciniata	X				
Myosotis laxa					B
Orthocarpus bracteosus	X				
Panicum occidentale	X			X	
Perideridia gairdneri				X	X
Perideridia oregana	X			X	X
Plagiobothrys figuratus	X		X		
Potentilla gracilis	X			X	
Prunella vulgaris	X	X			
Ranunculus occidentalis	X	X			
Ranunculus orthorhynchus	X				
Rorippa curvisiliqua	X				B
Sidalcea campestris	X				X
Sidalcea cusickii					X
Sidalcea virgata	X				X
Sisrynchium idahoense	X			X	
Tritelia hyacinthina				X	X
Veronica scutellata	X				
Wyethia angustifolia	X	X			
Zigadenus venenosus				X	X

Chapter 5: Introduction to Site Reports

Monitoring reports have been prepared for all active West Eugene Wetlands Mitigation Bank sites. The reports are found in the following section (Part 2: Chapters 6-15). There are currently ten mitigation sites within the monitoring program. Bank sites are monitored for a period of 5 or 7 years. The duration of monitoring is dependent upon which authorizing agreement mandated Bank operations at the time the MIP was approved. During the monitoring period, a variety of assessments are made of each site throughout the year.

The monitoring reports are utilized when assessing the mitigation's success in achieving the performance criteria and the overall performance of the mitigation. Qualitative assessments are made on a quarterly basis and seek to document site hydrology, non-native vegetative cover, and wildlife use. Quantitative vegetation assessments occur in years 2, 5, and 7 (if applicable). Analysis of collected data is considered against the performance criteria outlined in the site's MIP. The progress of the site towards meeting mitigation bank standards is assessed at this time. Both qualitative and quantitative data guide the maintenance activities prescribed for each site. The methods used in the collection of all data are discussed in detail in Appendix A.

The outline of each site report is given below. The reports begin with a description of the site, its history, and management goals. This section also includes a site map. A summary of the site's progress toward meeting mitigation bank performance criteria follows. The current year's management and maintenance actions, along with recommendations for future management actions, are also included. The final section summarizes the data collection and analysis that took place in the current year.

I. Site Name

A. Site Description

1. Size
2. Ownership
3. Site Timeline
4. Location
5. Site History
6. Focus of Prescriptions
7. Site-Specific Management Goals
8. Site Map

B. 2002 Monitoring Summary

1. 2002 Management Actions
2. Management Actions for 2003

C. Monitoring Results

1. Hydrology
  a) Methods
  b) Results
2. Vegetation
  a) Methods
  b) Results
3. Wildlife Utilization

Chapter 6: Amazon Creek Enhancement Unit

A. Site Description

1. Size: 5.71 acres

2. Ownership: City of Eugene

3. Site Timeline: **Table 6.1**

Section	Construction Year	Monitoring Period
Segment 1a *(Bailey Hill Rd to BP Station)*	1997	1998-2004
Segment 1b *(BP Station to W 11th Ave)*	1997 and 2002	1998-2004
Segment 2a *(Bertelsen Rd to Beltline Rd East ½)*	1997	1998-2004
Segment 2b *(Bertelsen Rd to Beltline Rd West ½)*	1997	1998-2004
Segment 3 *(Beltline Rd to Danebo Rd)*	1997	1998-2004
Segment 4 *(Danebo Rd to Terry St. bridge)*	1997 and 2002	1998-2004
Segment 5a *(Terry St. bridge to Powerlines)*	1997	1998-2004
Segment 5b *(Powerlines to Railroad tracks)*	1997	1998-2004

4. Location

The project spans some 1.75 miles along the Amazon Channel. It extends from Bailey Hill Road west and north to the Southern Pacific Railroad corridor.

5. Site History

Evidence from early survey documents recorded in the 1850's indicate that the drainage in west Eugene was not a single creek as it is today, but a series of swales running northwest to the Long Tom River. Early farming practices in the area probably began the process of draining the land to a single drainage corridor. Between 1950 and 1959, the U.S. Army Corps of Engineers deepened and channelized the drainage to enhance surface water conveyance and provide flood protection.

6. Focus of Prescriptions

Restore streamside riparian habitat and riverine wetland and create a streamside floodplain for this stretch of Amazon Creek. To accomplish this, a portion of the northern bank of each segment listed in Table 6.1 was laid back to increase channel capacity during high flow events and to improve riparian and wetland habitat along the stream. Figure 6.1 shows a schematic diagram of the desired future condition of the channel cross section in the locations of channel widening.

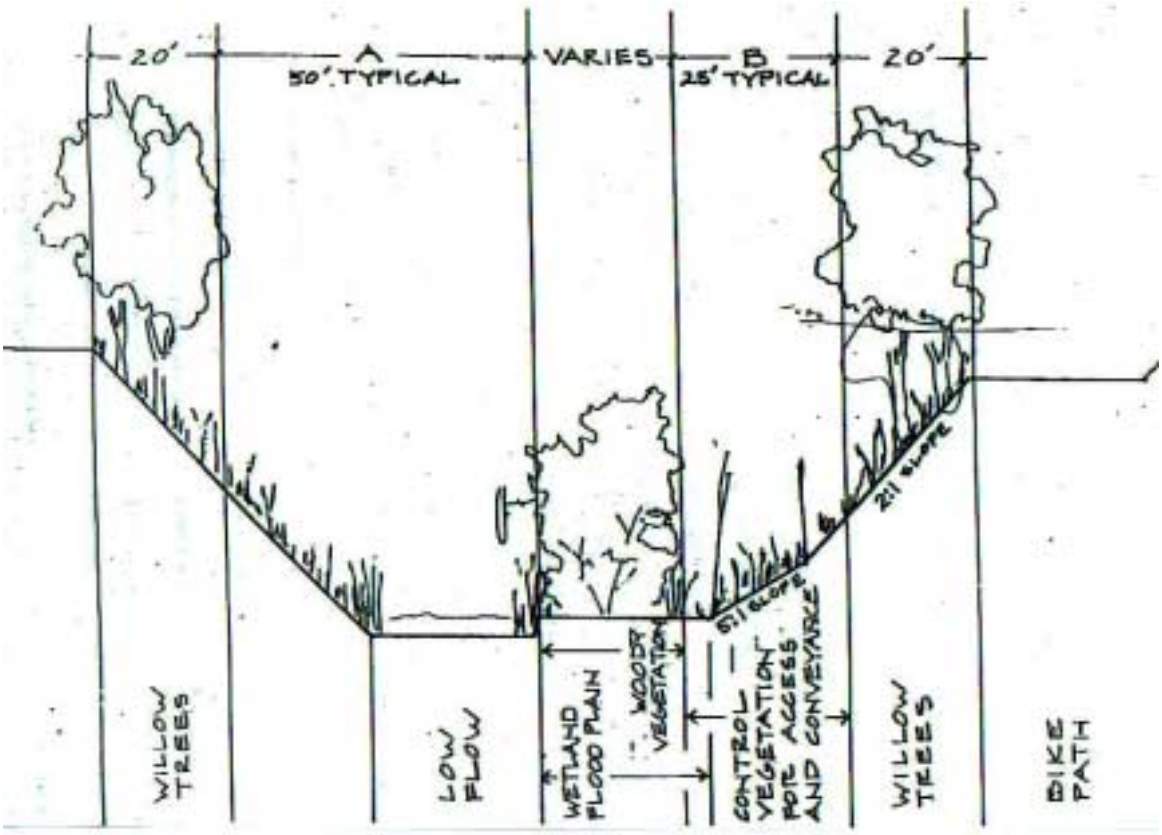


Figure 6.1. Amazon Channel desired conditions. Moving from left to right in the above diagram, the slope of south bank and the low flow channel of the creek were not altered, but willows were planted at the top of the bank to increase bank stability and to improve habitat conditions. The increase in wetland flood plain width was dependent on the available land area adjacent to the creek. The restored flood plain was also planted with willows and seeded with native vegetation. The north bank's ascent to the original bank height begins with an approximately 25' wide 5:1 slope, followed by and approximately 20' wide 2:1 slope. These areas were planted with habitat appropriate native seed mixes, as well as, willow and ash trees. The bike path runs parallel to the creek on top of the north bank for the majority of the enhancement corridor.

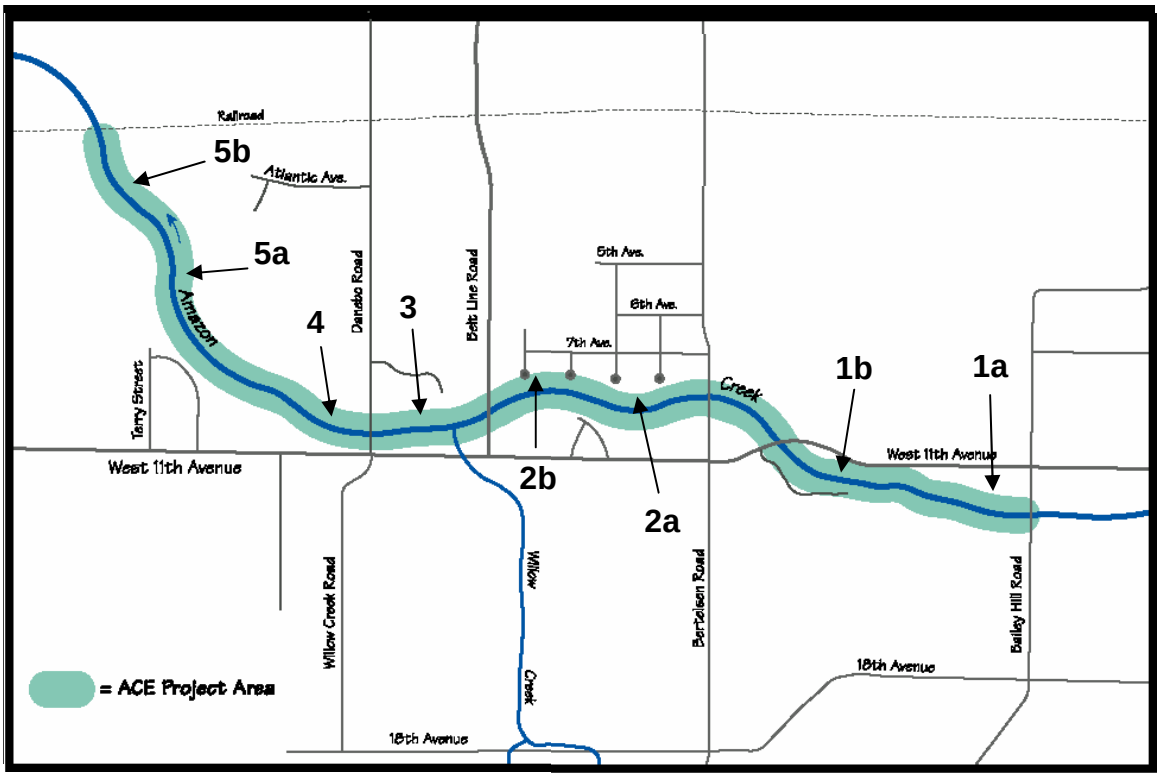


Figure 6.2. Amazon Creek Enhancement project area map. Each segment (1-5) of the project is labeled. The labels correspond to the reaches discussed in Table 6.1.

7. Site-Specific Management Goals

1. Inundation or saturation of the restored wetland flood plain for a minimum of 5% (2.7 weeks) of the growing season.
2. Establish hydric soils through periodic inundation and siltation in areas where hydric soils do not currently exist.
3. Establish hydrophytic vegetation along the restored wetland flood plain where greater than 50% of the dominant species are designated as OBL, FACW, or FAC
4. Restore vegetative cover throughout the riparian emergent and scrub/shrub communities along the restored wetland flood plains.

B. 2002 Monitoring Summary

Monitoring of hydrology and vegetation in 2002 revealed moderate success in meeting Mitigation Bank standards. Segments 1 and 2 appear to meet hydrology standards; however, the percent of saturated soils during the growing season on segments 3-5 appears to be too low to promote the development of hydric soils. Additionally, a portion of segment 4 has experienced severe erosion. Remedial action taken this fall will hopefully reverse this trend. Results from vegetation monitoring were equally varied. While all segments are dominated by hydrophytic vegetation, only segments 1 and 2 met the total cover goal and none of the reaches met native species cover goals. Willow establishment is proceeding slowly as well. The cover of willows did not exceed 25% in any reach.

1. 2002 Management Actions

Three areas received remediation this fall. In each section, the berm separating the main channel from the restoration was lowered to promote more frequent flooding during high water events. These areas

included: 1) west of Bailey Hill Rd and north of the Rexius wood products facility, 2) the restored wetland flood plain below the bike path overlook just east of the West 11th Avenue bike underpass, and 3) along the bike path overlook at PSC (Spectra Physics). In addition, the north and south banks of segments 1-3 were planted with native shrub and tree species, including 812 *Salix lasiandra,* 812 *Salix sitchensis*, 250 *Populus trichocarpa*, 1,424 *Cornus sericea*, and 300 *Fraxinus latifolia*.

2. Management Actions for 2003

1. Remove European birch from the segment between Beltline Road and Danebo Road.
2. Continue to mow the edge of the bike path to prevent the spread of non-native species into the adjacent restoration areas.
3. Monitor the success of the restored wetland flood plain enhancements and tree planting.
4. Remove the Harding grass along Segment 2 of the bike path.

Table 6.2. **Progress of the Amazon Creek Enhancement Unit segments towards meeting MOA vegetation standards.** The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. The restored floodplains of sections 1a, 3, and 5a were too small for sampling.

Site Characteristics and MOA Vegetation Standards	Segment 1b (Macroplot 1)	Goal Met?	Segment 2a & b (Macroplot 2)	Goal Met?	Segment 4 (Macroplot 3)	Goal Met?	Segment 5b (Macroplot 4)	Goal Met?
Site status in the monitoring period	Year 5 of 7	N/A	Year 5 of 7	N/A	Year 5 of 7	N/A	Year 5 of 7	N/A
Most recent quantitative data collected in:	2002	N/A	2002	N/A	2002	N/A	2002	N/A
80% vegetative **cover** after 5 years	94%	Yes	98%	Yes	58%	No	72%	No
50% of the dominant species will be OBL, FACW, or FAC Dominant species = > 10% cover	100%	Yes	100%	Yes	100%	Yes	100%	Yes
A minimum of 10 native species occurring at 2**% cover** within 5 years	1 species meets the standard	No	1 species meets the standard	No	1 species meets the standard	No	0 species meet the standard	No

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil on the restored wetland flood plain areas were estimated and mapped during site visits in the 2nd quarter (April-June) and the 4th quarter (Oct.-Dec.).

b) Results

Hydrologic function varies considerably from segment to segment within the project area; essentially the entire length of the restored wetland flood plain is functioning as a floodplain during storm events and serving flood conveyance objectives. These functions appear best served in segment 1b (BP Station to W 11th Ave) and segment 2 (Bertelsen Rd to Beltline Rd), where the restored wetland flood plain is widest and has encouraged development of an alternative high-flow channel. The removal of the berms in segments 1 and 3 will likely improve the performance of these areas as well.

Regarding the development of wetland hydrology characteristics in restored floodplain areas, 8 segments of the enhancement project were ranked based on the frequency and duration of inundation and amount of area with saturated soils during growing-season visits. The mean percent area of each segment that had saturated soils during 2nd and 4th quarter visits from 1998-2002 was calculated to help determine these relative rankings:

Good: an average of >55% of the area with saturated soils during growing season visits & relatively frequent & widespread inundation.

Fair: an average of 40%-55% of the area with saturated soils during growing season visits & a moderate amount of inundation.

Poor: an average of <40% of the area with saturated soils during growing season visits & only a small amount of inundation.

The results of this ranking are as follows:

Segment	Mean % Soil Saturation	Rank
1a *(Bailey Hill Rd to BP Station)*	58%	Good
1b *(BP Station to W 11th Ave)*	63%	Good
2a *(Bertelsen Rd to Beltline Rd East ½)*	55%	Good
2b *(Bertelsen Rd to Beltline Rd West ½)*	79%	Good
3 *(Beltline Rd to Danebo Rd)*	37%	Poor
4 *(Danebo Rd to Terry St. bridge)*	55%	Fair
5a *(Terry St. bridge to Powerlines)*	44%	Fair
5b *(Powerlines to Railroad tracks)*	41%	Fair

Following are additional descriptions of the hydrology of the 8 segments and any changes noted in 2002:

Segment 1a (Bailey Hill Rd→BP Station)
This segment contains a relatively narrow restored wetland flood plain and straight stream channel. A number of small pools have developed along the streamside edge of the restored wetland flood plain. The berm was lowered along this a portion of this segment in 2002 to enhance the hydrologic functioning of the floodplain.

Segment 1b (BP Station →W 11th Ave)
This segment contains the widest restored wetland flood plain of the entire project. The restored wetland flood plain contains 2 swales that serve as secondary channels during high water. The north swale (furthest from the creek channel) appears to be effective at catching sediment deposits, as it has grown somewhat shallower and wider in places. The berm was removed along this segment in 2002 and the central swale was improved to increase the use of this alternative channel.

Segment 2a (Bertelsen Rd→Beltline Rd East ½)
Despite the relatively narrow restored wetland flood plain, this site appears to retain a considerable amount of water. Most of the soils in this segment were saturated and there were also several shallow pools on the eastern portion of the reach.

Segment 2b (Bertelsen Rd→Beltline Rd West ½)
This segment contains a long, moderately-wide restored wetland flood plain with a number of large and small pools that develop during the wet season. Soils are generally saturated over most of this segment. There is a culvert draining from Nolan West into the western-most section of this reach. The culvert, combined with the general constriction of the channel at this point, creates an emergent area that persists throughout the summer and fall. It is the only section along ACE where bullrushes and *Eleocharis* spp. are the dominant vegetation.

Segment 3 (Beltline Rd→Danebo Rd)
This section continues to function well during high water events, but remains relatively dry during the interim. Pooling was again absent this fall. Consistent with previous observations, the wettest soils were located adjacent to a drainage pipe that provides a surface water connection from the Nolan mitigation site.

Segment 4 (Danebo Rd→Terry St. bridge)
This segment contains a moderately wide restored wetland flood plain, much of which is composed of exposed, rocky parent material. A large swale that serves as a secondary channel during high water has developed along most of the length of the restored wetland flood plain. This swale is scoured by high-flow events, exposing the parent material. The berm was lowered along part of this segment in 2002. Additional structures and plantings were placed in the secondary channel in an effort to slow the flow of water during high water events.

Segment 5a (Terry St. bridge→Powerlines)
Segment 5a consists of a moderately narrow restored wetland flood plain with scattered, small pools along the creek-side edge. Of these small pools, some are partially fed by culverts, while others were naturally occurring.

Segment 5b (Powerlines→Railroad tracks)
This segment contains a slightly wider restored wetland flood plain than segment 5a, with a number of small to medium sized pools. Outdoor recreation vehicle use in this area in 2000 created some additional depressions and tracks where water continues to collect.

2. Vegetation

a) Methods

Point-intercept data were collected in the largest four segments: 1b, 2, 4a, and 5b. The macroplots sampled in each of the four segments are labeled 1, 2, 3, and 4, respectively. A total of 228 points were sampled on June 13th in segment 1b (MP 1), 238 points were sampled on July 8th in segment 2 (MP 2), 190 on July 9th and 10th in segment 4a (MP 3), and 280 points on July 10th in segment 5b (MP 4).

b) Results

Data show that all macroplots are having difficulty meeting vegetation standards. While macroplots 1 and 2 met the goal of 80% vegetative cover after 5 years and all macroplots are dominated by hydrophytic vegetation, macroplots 3 and 4 did not meet the total vegetative cover goal. Additionally, no macroplot met the native cover goal of 10 native species with > 2% cover. The establishment of riparian emergent and scrub/shrub communities along the restored wetland flood plain areas, currently measured by the cover of willow species, is also progressing slowly. The percent cover of willows did not exceed 25% in any macroplot.

The invasion of introduced species continues to be a problem. Bent grass (*Agrostis* sp.) and Reed canarygrass (*Phalaris arundinacea*) in the channel and the restored wetland flood plain areas are of particular concern, while Harding grass (*Phalaris aquatica*) is of concern on portions of the upper bank slopes and along the bike path.

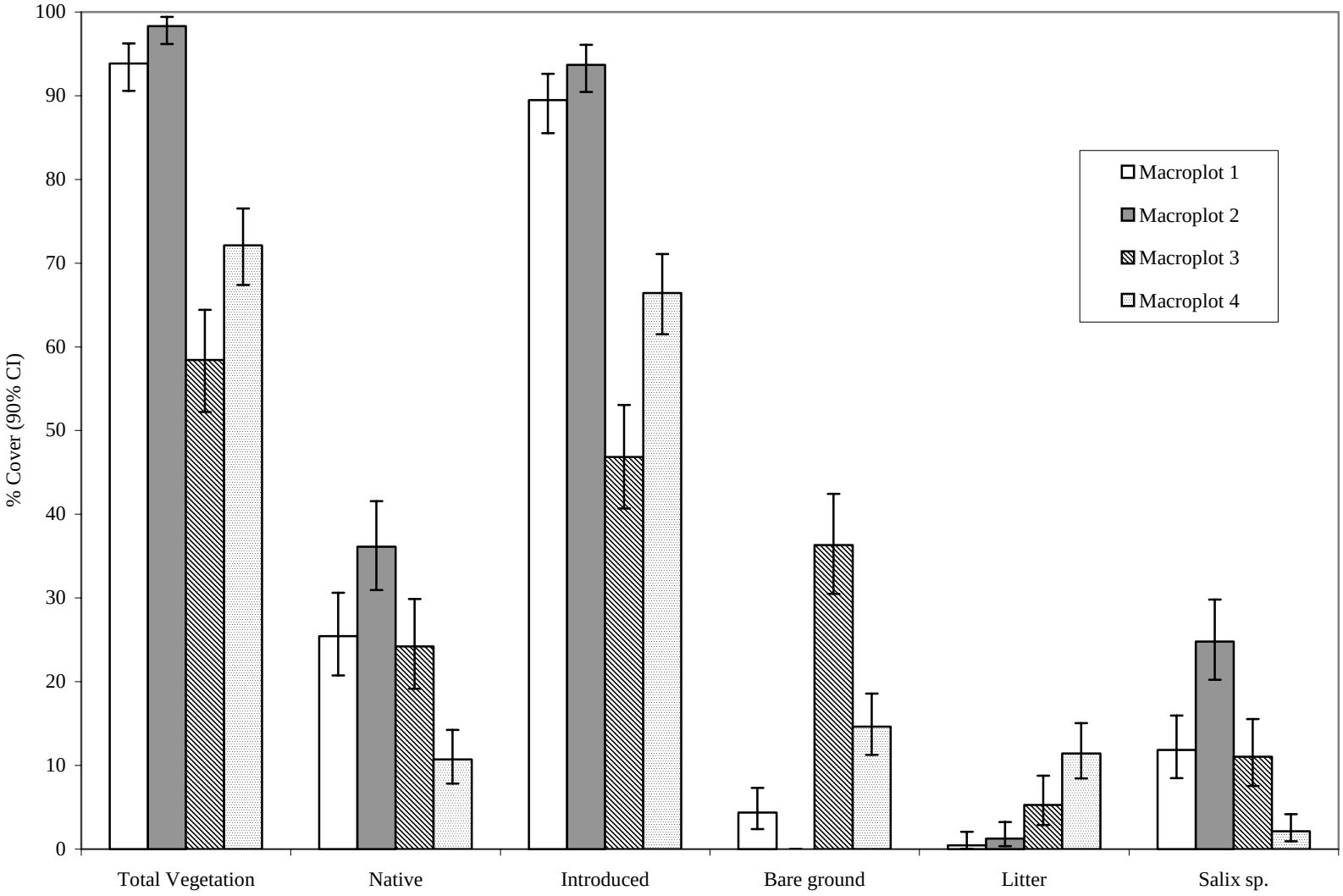


Figure 6.3. Percent cover of ground cover guilds along the Amazon Channel Enhancement Project. The total, native, introduced, bare ground, and litter percent covers are graphed, along with the total cover of Salix species, for all macroplots along the Amazon bank restorations.

3. Wildlife Utilization

Wildlife use was similar to that observed between 1999 and 2001. The most commonly observed wildlife included great blue herons, mallards, and Canada geese. Other birds using the riparian area included green-backed heron, killdeer, greater yellowlegs, ring-necked pheasant, tree swallows, violet-green swallows and barn swallows, scrub jay, American crow, common yellowthroat, house finch, common merganser, belted kingfisher, and long-billed curlew. In addition, common garter snakes, Pacific tree frogs, beaver, and raccoons were seen, as well as several introduced wildlife species including bullfrogs, nutria, and carp. A freshwater clam commonly observed in the creek channel and in saturated soils was identified to the genus *Anodontoni*.

Chapter 7: Balboa Unit

A. Site Description

1. Size: 74.1 acres

2. Ownership: BLM, City of Eugene

3. *Site Timeline:* Table 7.1

Section	Year of Construction	Acreage	Monitoring Period
Atlantic/Pacific Phase 1	1998	7.9 acres total of both A/P and Phase 1	1999-2003
Phase 2	1999	1.57 acres	2000-2004
Enhancement	1999	10 acres	2000-2004

4. Location

West side of Danebo Road, adjacent to the north bank of Amazon Creek. TRS, Tax lot #:17-04-33-20 tax lots: 603 and 700

5. Site History

Over the course of the last 60 years this site has been topographically modified to serve as an airfield and a racing drag strip. Prior mitigation prescriptions were executed for the development of Ross Industrial properties located to the north and east along Danebo Ave. These prescriptions removed segments of the former airstrip runway.

6. Focus of Prescriptions

Restoration and enhancement of a large, continuous wetland tract adjacent to Amazon Creek that connects adjacent grasslands and enhances the wildlife corridor. Frontage along Amazon Creek exposes the public to a variety of wetland community types occurring within the west Eugene system. Prescriptions include removal of the remaining runway, removal of fill material, removal of noxious and invasive species, and seeding/planting of native grasses and forbs. In addition, an upland area will be enhanced to serve as a buffer from adjacent industrial land use and a trail system will be developed through the unit

7. Site-Specific Management Goals

1. Restore wet prairie and emergent wetland vegetation to areas proposed for fill removal.
2. Enhance existing wet prairie vegetation by removing invasive woody vegetation and maintaining as prairie through periodic burning and/or mowing on a portion of the wetland area that has moved from wet prairie to scrub-shrub wetland.
3. Restore native wet prairie and emergent wetland conditions by removing fill material to the original hydric soil surface.
4. Enhance habitat conditions for native wildlife species associated with wet prairie and emergent wetland habitats.
5. Maintain upland areas in native vegetation.

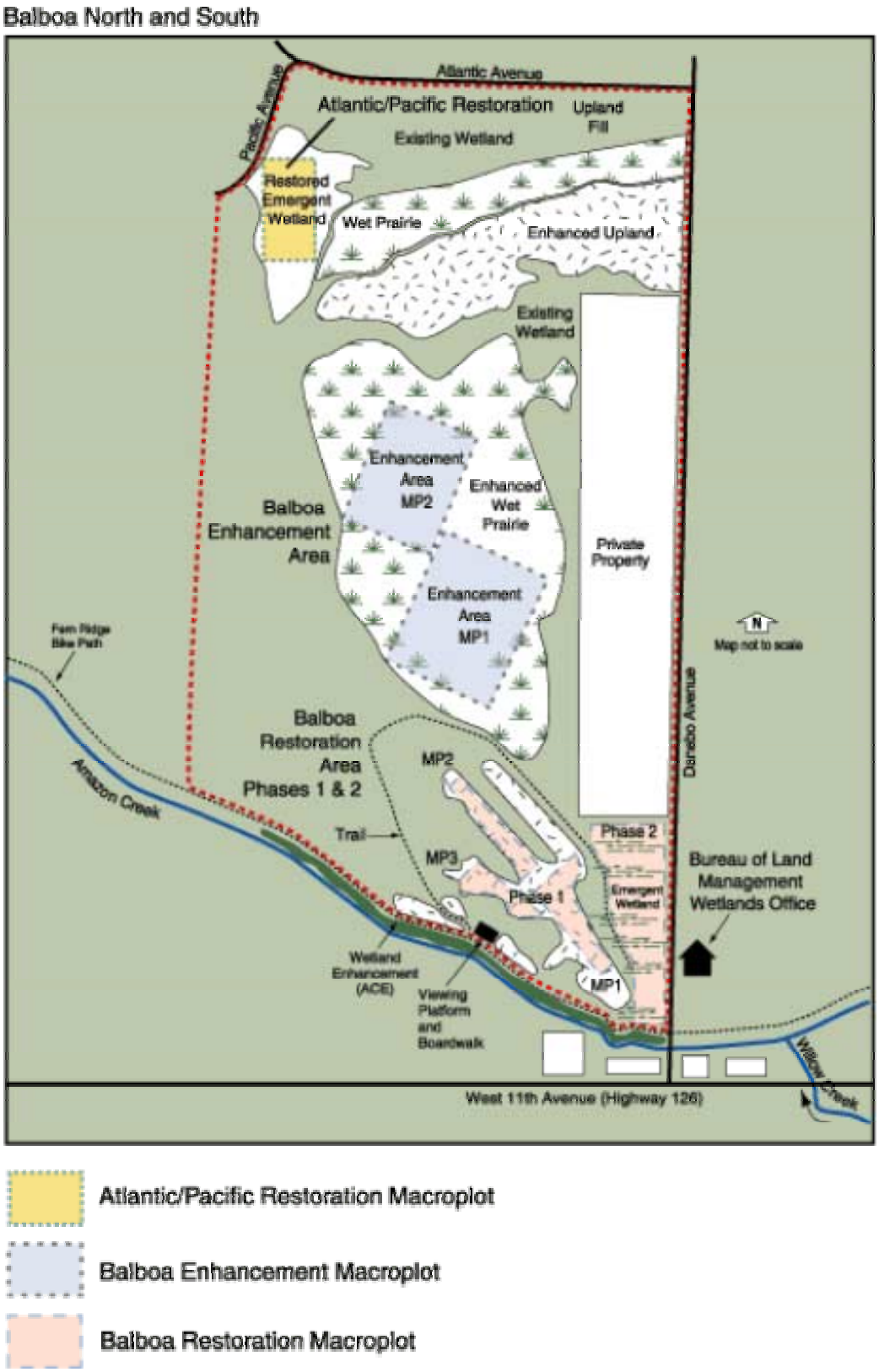


Figure 7.1. Balboa Site Map. The Enhancement area, Phases 1 and 2 restorations, and the Atlantic/Pacific restoration are labeled with their associated macroplots. Although not labeled as such, the area within the red project line that is shaded green is existing wetland.

B. 2002 Monitoring Summary

While the hydrology of most of the sections of this unit, with the exception of Atlantic/Pacific, is sufficient for hydric soils development, the progress of each section in promoting native wetland vegetation varies from section to section. Phase 1 appears to be progressing well, with a high percentage of native species, but introduces species such as *Mentha pulegium* continue to threaten this section's stability. Phase 2 was very close to meeting 2nd year native cover goals in 2001, but there is still a large percentage of bare ground. Monitoring of the rare species in the enhancement area shows mixed results by species. The continued decline of *Horkelia congesta* var. *congesta* is problematic. More woody vegetation will be removed in the coming summer. Hopefully, this will aid the rare plant populations over time. A sinkhole on the Atlantic-Pacific section caused the water level in the emergent pools to drop more quickly than they would have otherwise. The area will be monitored for further sinkhole development.

1. 2002 Management Actions

Phase 1 Restoration:

1. Maintenance crews spent three days hand pulling exotics and two days focusing on pulling pennyroyal only.
2. The northern perimeter was solarized to remove non-native perennial grasses and other exotics and reseeded in early-fall.
3. The bike path edge was mowed to prevent exotic plant seed spread and keep vegetation out of the bike path.

Phase 2 Restoration:

1. Maintenance crews spent three days hand pulling pennyroyal and other exotics from the vernal pools
2. The bike path edge was mowed to prevent exotic plant seed spread and to keep vegetation out of the bike path.

Enhancement specific actions:

1. A maintenance crew spent three days removing invasive woody shrubs.
2. Several patches of reed canarygrass were solarized and reseeded in early-fall.
3. In the southwest corner near the bend in the path, areas where pennyroyal was present with a >50% cover were tilled and then seeded.
4. All reed canarygrass populations were mowed prior to seed development.

Atlantic/Pacific:

1. The perimeter of the site was mowed to prevent the spread of invasive species into the interior of the restoration.
2. Patches of reed canarygrass were mowed to prevent spread of their seed.
3. A sinkhole caused by problems with underground sanitary and storm sewer pipes was filled and an appropriate native seed mix was spread over the areas of exposed soil.
4. A portion of the area surrounding the northern vernal pool/emergent area was scrapped and replanted with an appropriate native seed mix.

2. Management Actions for 2003

Trail:

1. The areas adjacent to the bike path will be mowed to prevent the spread of exotics from invading the restoration and enhancement areas.
2. The path should be treated with the infrared burner to retard weed growth and maintain the path surface.

Phase 1 Restoration:

1. Continue yearly hand weeding.
2. Overseed restoration area near bike path to increase diversity.
3. Continue mowing the bike path edge.

Phase 2 Restoration:

1. Continue yearly hand weeding.
2. Continue mowing the bike path edge.
3. Remove patches of *Holcus lanatus*, *Daucus carota*, and *Leucanthemum vulgare* in the southeastern portion of the restoration.

Enhancement specific actions:

1. Map the extent of non-native perennial grasses and then develop a plan to address any problem species.
2. Continue to remove woody species encroaching on the enhancement area and mow perimeter of burn area in preparation for burn.
3. Mow/ treat areas of reed canarygrass with methods appropriate to the size of each patch (i.e., hand pull, solarize, etc.)
4. Grind tree stumps to prevent resprouting.

Atlantic/Pacific:

1. Continue to mow the perimeter.
2. Monitor the restoration for additional sinkhole development.
3. Assess the newly seeded areas and weed as needed.

Table 7.2. Progress of the Balboa Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Phase 1	Goal Met?	Phase 2	Goal Met?	Atlantic/ Pacific	Goal Met?
Site status in the monitoring period	Year 4 of 5	N/A	Year 3 of 5	N/A	Year 4 of 5	N/A
Most recent quantitative data collected in year:	PI - 2000	N/A	PI - 2001	N/A	PI - 2000	N/A
50% native **cover** after 2 years	61%	Yes	49%	Yes	51%	Yes
70% native **cover** after 5 years	2003	TBD	2004	TBD	2003	TBD
75% of those species occurring at a 50% **frequency** rate or greater shall be from the Native Plant list	2003	TBD	2004	TBD	2003	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2003	TBD	2004	TBD	2003	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2003	TBD	2004	TBD	2003	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2003	TBD	2004	TBD	2003	TBD

Table 7.3. Progress of the Balboa Unit enhancement towards meeting the MIP vegetation standards. The most recent data for the enhancement is compared to its relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 3 of 5	N/A
Most recent quantitative data collected in:	1999 (baseline data)	N/A
60% reduction of total shrub cover after 5 years	2003	TBD
70% reduction of tree density after 5 years	2003	TBD

C. Monitoring Results

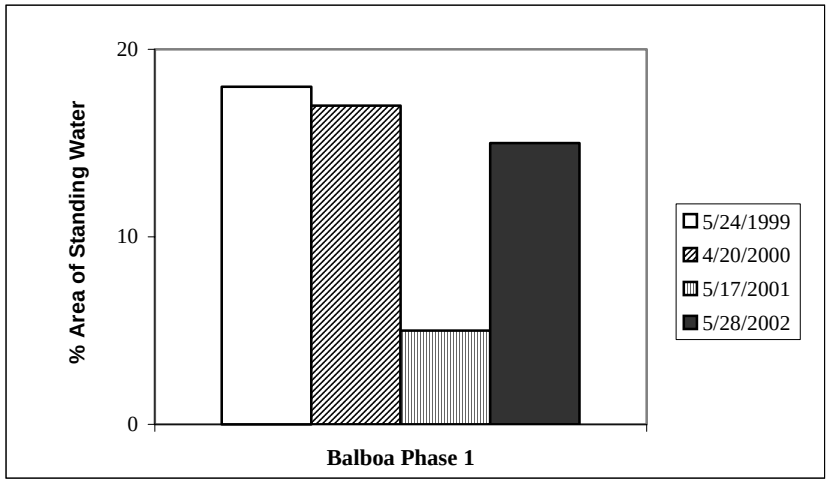
1. Hydrology

a) Methods

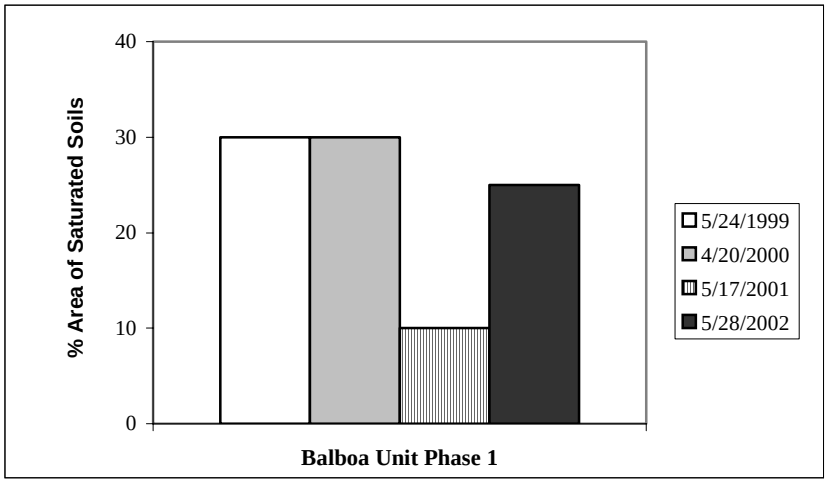
The extent of standing water and saturated soil were estimated and mapped during a site visit in the 2nd quarter (April-June). Each phase receives an estimate. Water depths were also measured monthly at 2 staff gauges.

b) Results

Observations during 2002 indicate that the hydrology of Phase I, II and the enhancement area is sufficient to support hydric soil development. Saturated soils persisted over the site into the growing season at depths appropriate for native wetland vegetation establishment. A sinkhole developed in the northern section of Atlantic-Pacific. It is associated with the location of underground utilities (sanitary and storm sewer pipes). This caused the water depth to decrease faster than would occur otherwise. The sinkhole was filled and the area was reseeded this fall. Additional monitoring will be needed to ensure that the proper hydrology is created and maintained.



Fi**gure 7.2. Spring standing water in Phase 1 of the Balboa Unit.** Percentage of Phase 1 with standing water in the early spring over the history of the restoration.



F**igure 7.3. Spring saturated soils in Phase 1 of the Balboa Unit.** Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

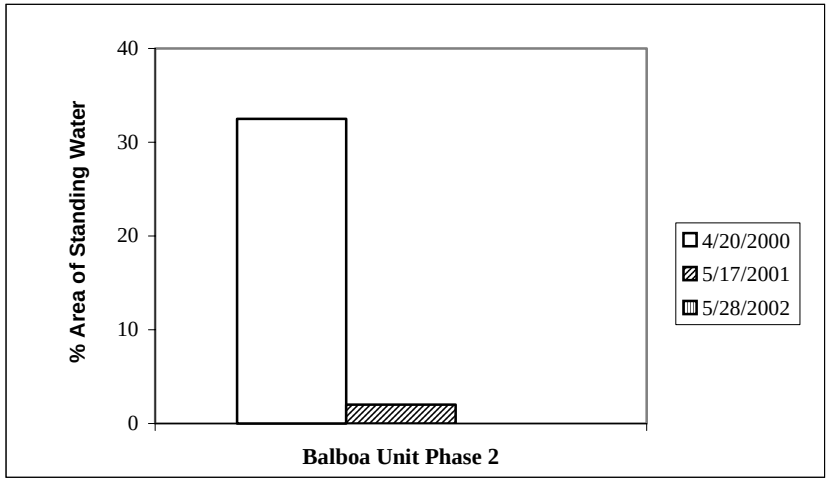


Figure 7.4. Spring standing water in Phase 2 of the Balboa Unit. Percentage of Phase 2 with standing water in the early spring over the history of the restoration.

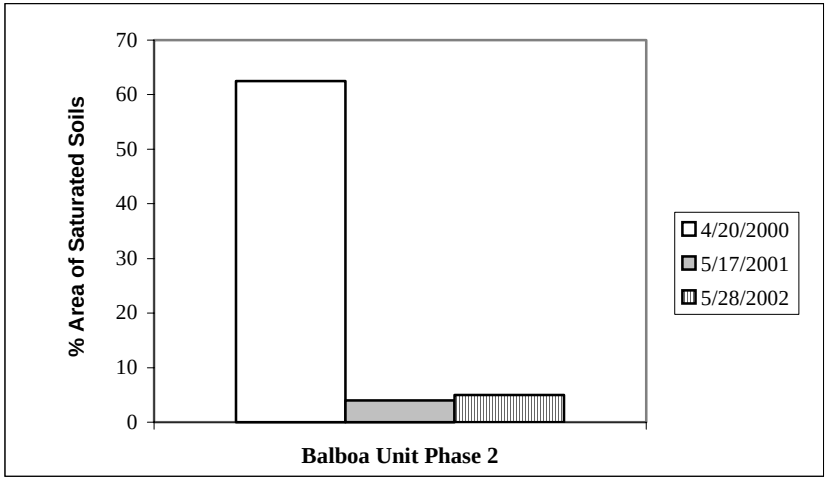


Figure 7.5. Spring saturated soils in Phase 2 of the Balboa Unit. Percentage of the Phase 2 with saturated soils in the early spring over the history of the restoration.

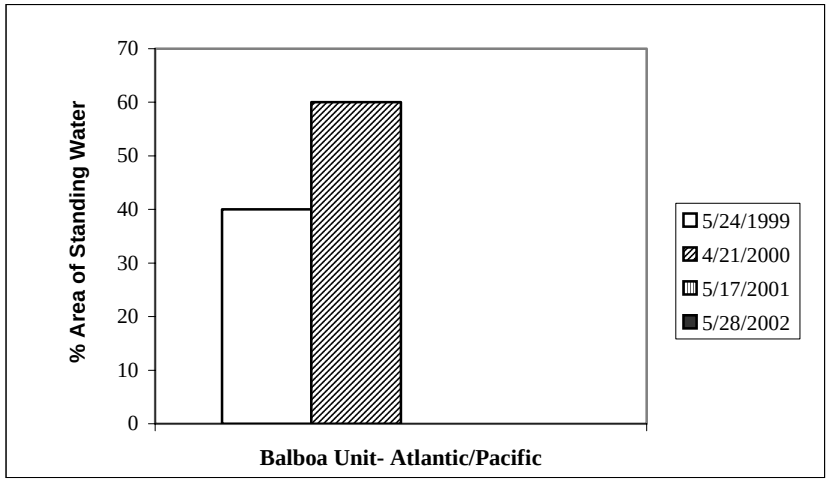


Figure 7.6. Spring standing water in the Atlantic/Pacific portion of the Balboa Unit. Percentage of Atlantic/Pacific with standing water in the early spring over the history of the restoration.

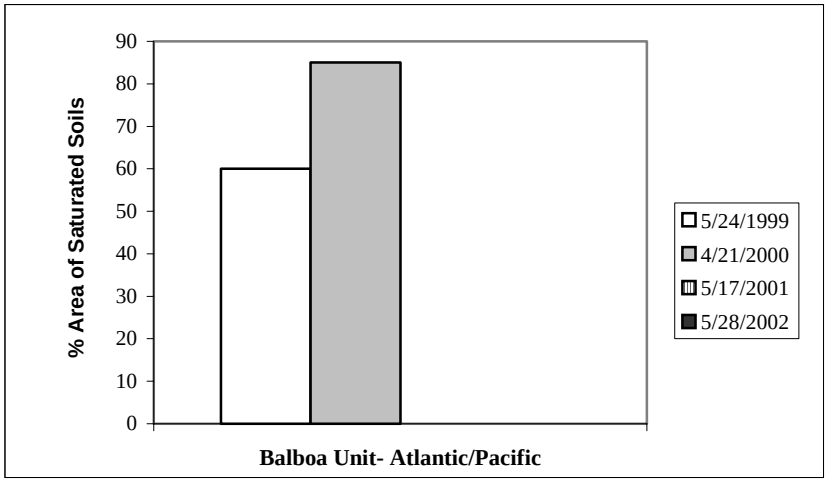


Figure 7.7. Spring saturated soils in the Atlantic/Pacific of the Balboa Unit. Percentage of the Atlantic/Pacific with saturated soils in the early spring over the history of the restoration.

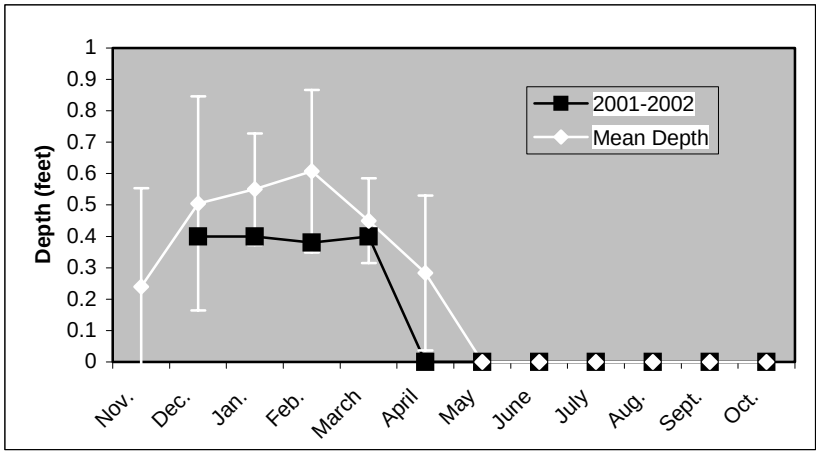


Figure 7.8. Balboa Phase 1 inundation levels in the eastern section during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depth of inundation throughout the year in the eastern section in 2001-2002. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed.

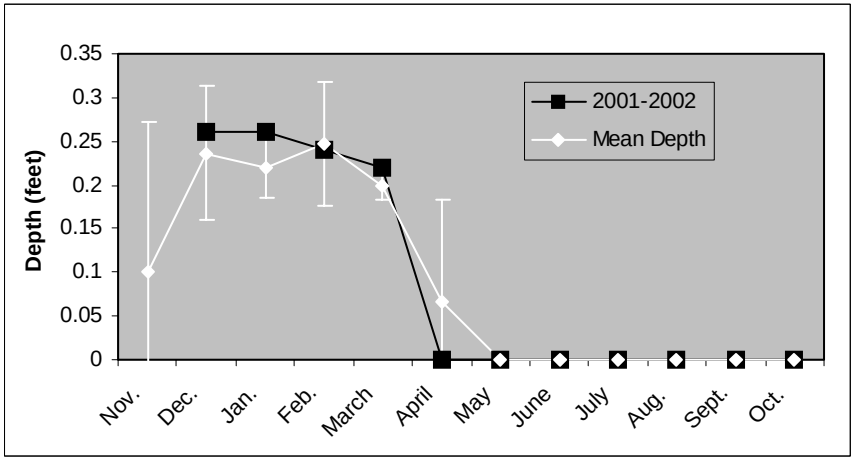


Figure 7.9. Balboa Phase 1 inundation levels in the western section during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depth of inundation throughout the year in the western in 2001-2002. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed for comparison.

2. Vegetation

a) Methods

Rare species monitoring on the Balboa Unit enhancement area is required annually. Monitoring was conducted on June 21st, 22nd, and 26th. Three rare plant species were monitored. Data collection included:

- Frequency of *Aster curtus* in 2464 $1m^2$ quadrats
- Complete census, number of reproductive plants, and number of inflorescences per reproductive plant for *Erigeron decumbens* ssp. *decumbens*
- Complete census, numbers of seedling, vegetative, and reproductive plants, and number of inflorescences per reproductive plant for *Horkelia congesta* var. *congesta*

No other quantitative vegetation monitoring was conducted in the Phase 1, Phase 2 or Atlantic-Pacific restorations. Qualitative monitoring for the site did include an update to the plant species list for the entire Balboa Unit. These lists can be viewed in Appendix B.

b) Results

After only three years of data collection, the trends in the populations of rare species on the site remain unclear. The population of *Horkelia congesta* var. *congesta* continued its slight decline. The overall number of *Erigeron decumbens* ssp. *decumbens* crowns also continues to decline. However, both species show an increase in the total number of flowers produced by the population. Only the *Aster curtus* population appears to be increasing.

The data collected in 1999 was before the initial woody vegetation removal, and can therefore be used to begin to investigate the effects of woody vegetation removal on these populations. It appears that the removal of trees and shrubs has not adversely impacted any species in particular and has likely helped to promote the population expansion of *Aster curtus*. It also appears that, despite its apparent decline in number of crowns, the removal of woody vegetation may have had some great influence on the number of flowers produced by the crowns of *Erigeron decumbens* ssp. *decumbens* and minor influence on *Horkelia congesta* var. *congesta*. The flowering of *Erigeron decumbens* ssp. *decumbens* has increased by 61%.

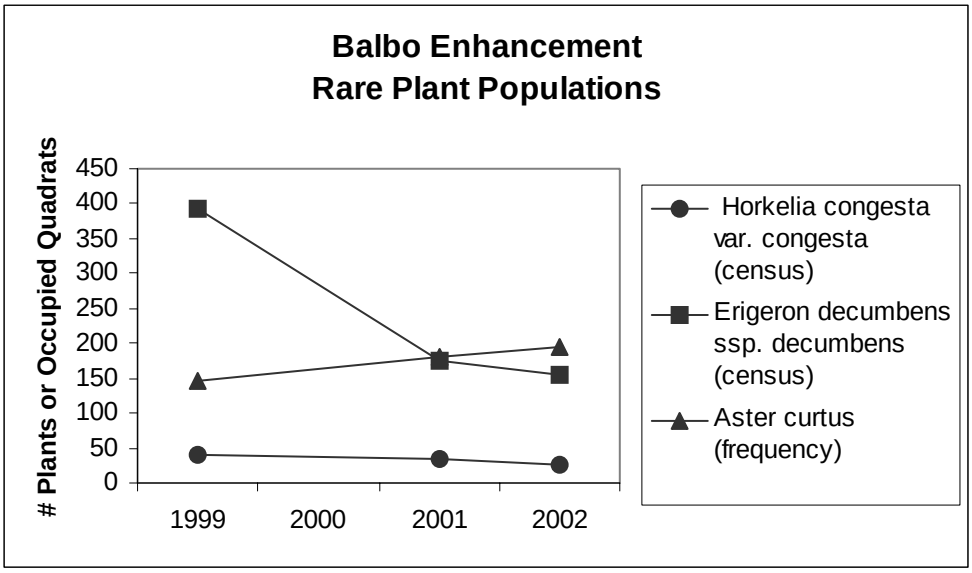


Figure 7.10. Rare plant population trends on the Balboa enhancement. Census data for *Horkelia congesta* var. *congesta* and *Erigeron decumbens* ssp. *decumbens* and frequency data for *Aster curtus* are plotted from 1999-2002, excluding 2000.

Erigeron decumbens ssp. *decumbens*
This species' population declined only slightly in the overall number of crowns from 2001; however, it's reproductive capacity increased this year above 1999 levels in terms of the percent of reproductive plants and the total number of flowers.

Table 7.4. *Erigeron decumbens* ssp. *decumbens* population trends from 1999, 2001, and 2002. Attributes for the *Erigeron decumbens* ssp. *decumbens* population on the Balboa Unit enhancement are given for 1999, 2001, and 2002.

Erigeron decumbens ssp. decumbens	**1999**	**2001**	**2002**
Total # of plants	394	175	156
% of plants reproductive	71.1%	48.6%	96.7%
Avg. # of flowers per reproductive plant	4.82	11.2	14.4
Total # flowers	1349	1736	2175

Horkelia congesta var. *congesta*
The *Horkelia congesta* var. *congesta* population continues to decline, with a decrease from 1999 of 14 individuals. Continued monitoring will be necessary to determine if more drastic management actions will be needed to sustain the population.

Table 7.5. *Horkelia congesta* var. *congesta* population trends from 1999, 2001, and 2002.
Attributes for the *Horkelia congesta* var. *congesta* population on the Balboa Unit enhancement are given for 1999, 2001, and 2002.

Horkelia congesta var. congesta	1999	2001	2002
Total # of plants	39	33	25
% of plants reproductive	51.3%	48.5%	96.0%
Avg. # of flowering stems per reproductive plant	1.55	1.87	1.87
Total # flowering stems	31	30	45

Aster curtus
Despite consecutive springs with low precipitation levels, the *Aster curtus* population increased in frequency from 1999 to 2001. This was also true for the population observed at the North Green hill Ash Grove Unit and may indicate that the species is a good competitor in dry conditions.

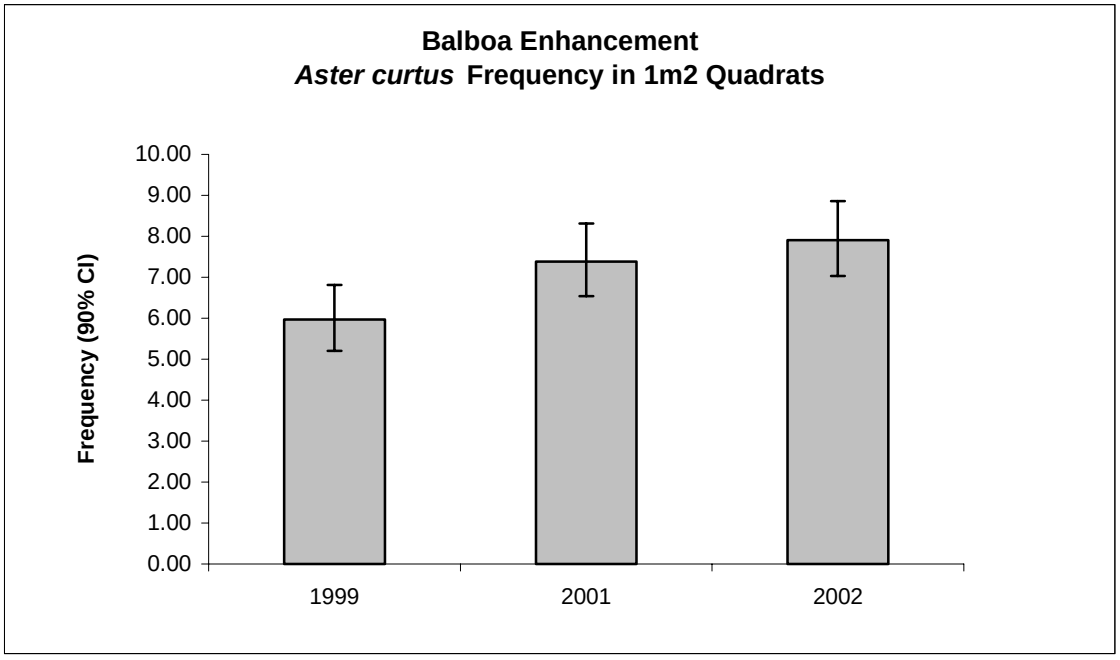


Figure 7.11. *Aster curtus* frequency on the Balboa Unit enhancement from 1999 to 2002. The frequency of *Aster curtus* is given for 1999, 2001 and 2002 with 90% confidence intervals.

3. Wildlife Utilization

The Balboa Unit remained a popular site for wildlife and the species sighted were similar to those of previous years. Canadian geese, mallards and killdeer were the most commonly sighted waterfowl. In addition to waterfowl, common garter snakes and Pacific treefrogs were also observed on the site. A ringneck snake was also transplanted from the Nolan Unit because of construction there. A great egret was also seen in the northwest wet area.

Chapter 8: Beaver Run Unit

A. Site Description

1. Size: 23.3 acres

2. Ownership: BLM

3. *Site Timeline:* Table 8.1

Section	Year of Construction	Monitoring Period
Enhancement	1998	1999-2004
Phase 1	1998	2000-2004
Phase 2	1999	2000-2004

4. Location

The Beaver Run Unit of the Danebo West Management Area is located to the south of Amazon Creek, north of W. 11th Street, and west of Danebo Avenue, Eugene, Or.

5. Site History

Woody vegetation was invading the existing wet prairie within which there are documented populations of rare herbaceous species. Soil, concrete and rubble have been historically dumped in a 2-acre area on site. Currently three outfall pipes drain the site directly into Amazon Creek. Prior to channelization, Amazon Creek flowed through the site. Remnants of the historic Amazon channel remain on site. These fragmented reaches exhibit oxbow-like characteristics. The resident beaver population was constructing dams and actively altering site hydrology resulting in a transition of community types including a net loss of wet prairie. An atypical hydrologic condition existed as surface water was conveyed across the unit during summer months introduced through irrigation of lands upstream. Coupled with beaver activity, site hydrology was being adversely impacted in the context of the goals established for protection of this unit within the WEWP.

6. Focus of Prescriptions

Restoration and enhancement focus on the emergent and wet prairie communities. Site hydrology is still in transition because of external influences, but fill materials were removed. Vegetative treatments include removal of invasive herbaceous and woody species across the unit and seeding of native grasses and forbs. The overall goal for the project is to stabilize site hydrology so hydrologic conditions favor perpetuation of a diverse wet prairie community. Additional goals for the Unit include: enhancement of the woodland adjacent to the levee, enhancement of the emergent pools, and enhancement of habitat for resident wildlife (common western garter snake, beaver, great blue heron, red wing blackbird, western pond turtle).

7. Site-Specific Management Goals:

1. Restore wet prairie vegetation to areas of proposed fill removal.
2. Establish hydrophytic vegetation within the restoration and enhancement areas by planting, seeding and/or natural colonization.

3. Enhance wet prairie vegetation by removing woody vegetation and maintaining as prairie through periodic mowing on a portion of the wetland area that has transitioned from wet prairie to scrub-shrub wetland.
4. Establish wetland hydrology within the restoration area.
5. Improve overall hydrology across the Unit by reestablishing east to west cross-site flow.
6. Stabilize hydrology across the Unit.
7. Enhance habitat conditions for native wildlife species associated with wet prairie and emergent wetland habitats.
8. In Phase 2, explore the usefullness of biosolid application in the establishment of native wetland plants.

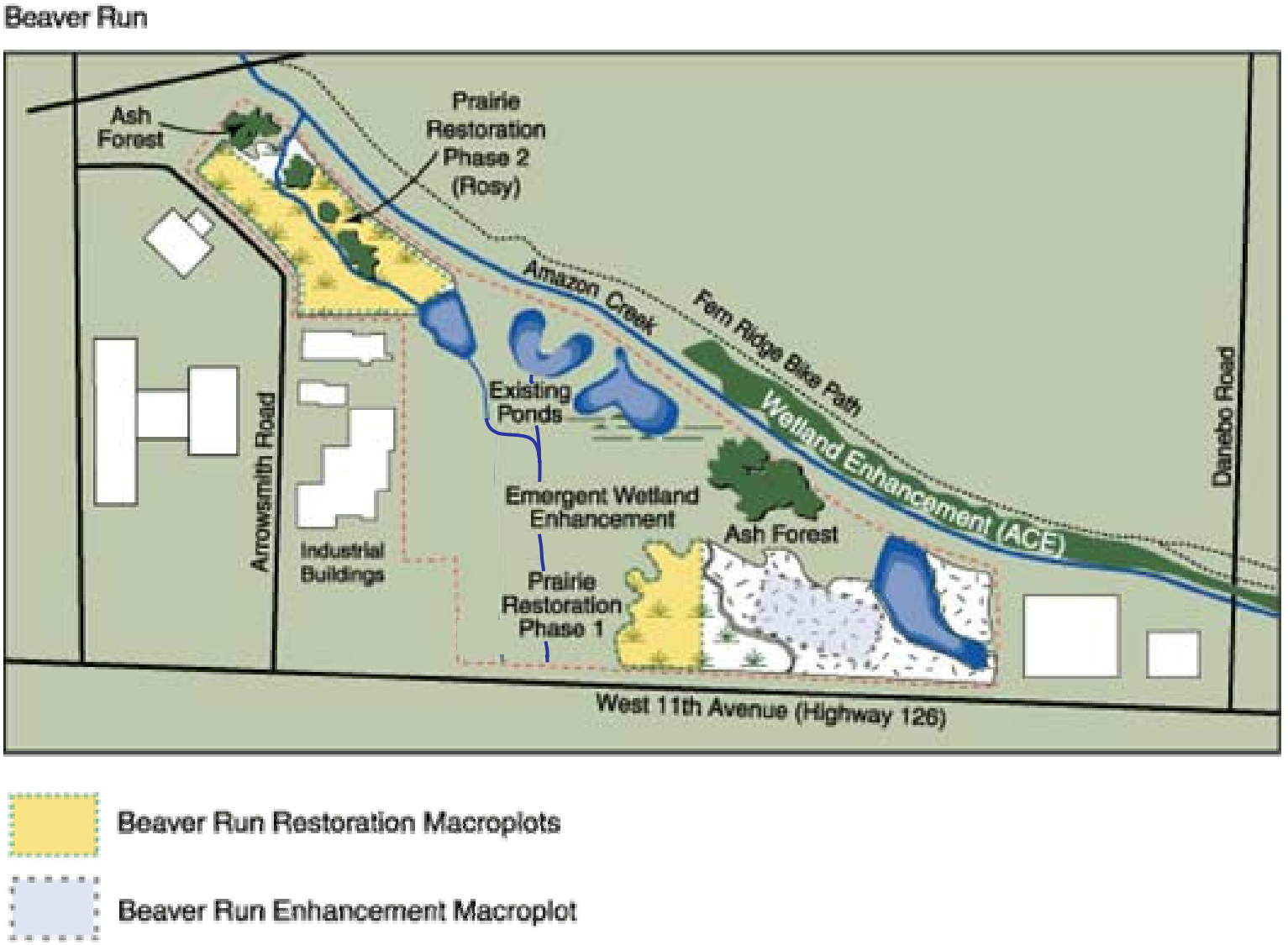


Figure 8.1. Beaver Run Site Map. The Enhancement area and the Phases 1 and 2 restorations are labeled with their associated macroplots. The area under the enhancement area and both phases are wet prairie habitat.

B. 2002 Monitoring Summary

Beaver Run continues to be a challenging site. While the hydrology of the site is sufficient to support hydric soil and vegetation development, woody species and exotic vegetation threaten its progress. This year, a large amount of woody vegetation was removed from the northeastern and eastern sections of the enhancement area, but this will need continued maintenance in the future to make the progress permanent. Reed canarygrass has been a constant threat to the Enhancement and Phase 1 areas. This fall, two ditches were enhanced to speed spring drainage of the site, which will hopefully allow for an early season mowing. Phase 2 hydrology and vegetation are doing well, but annual removal of invasive species is necessary for continued success in meeting vegetation standards. A disturbance to the southeastern portion of the enhancement area was created when an EWEB water main ruptured under West 11th Ave. Remedial actions were taken to repair the damage to the site. See #10 under '*Enhancement specific actions'* for details.

1. 2002 Management Actions

Phase 1 Restoration:

1. Maintenance crews spent three days hand pulling exotics.
2. Maintenance crews spent two days hand pulling pennyroyal.
3. The perimeter was mowed.

Phase 2 Restoration:

1. Maintenance crews spent three days hand pulling pennyroyal and other exotics from the vernal pools.
2. Maintenance crews mowed blackberry along the western fence line.
3. Maintenance crews removed seedling reed canarygrass from the swale.
4. The perimeter was mowed.
5. A remedial action removed nutrient poor sub-soils and widened the swale on the northwestern end of the site. The area was then seeded.

Enhancement specific actions:

1. The North/South ditch on the western edge of Phase 1 was scrapped to remove blockages and enhance drainage of the site.
2. A shallow swale was created to connect the westernmost ditch toward Phase 2.
3. The edges of ponds were scraped and can now be more easily mowed.
4. An area of reed canarygrass sod was scraped on the northwest portion of the site. The grass mats were pushed into windrows and will either be composted on site or hauled off later.
5. All disturbed areas were seeded with highly competitive species in low diversity mixes.
6. Two flashboard risers were installed for water control. One of these is on the outlet of the eastern remnant channel. The second is on outlet of the western remnant oxbow.
7. The enhancement area was mowed in September to reduce woody vegetation.
8. Tree stumps in the enhancement area were ground to prevent resprouting.
9. An EWEB water main ruptured in the West 11th Avenue right-of-way adjacent to the southeastern section of the enhancement area. The subsequent disturbance to the site was repaired by bring in fill for the bank, removing the roadbed material (approximately 30 cubic yards) that washed onto the site, and then seeding the area of soil disturbance.

2. Management Actions for 2003

Phase 1 Restoration:

1. Continue yearly hand weeding.
2. Re-survey the restoration to delineate the perimeter of the Phase 1 restoration area.
3. Solarize patches of reed canary grass within the restoration's perimeter.

Phase 2 Restoration:

Continue yearly hand weeding focusing on remediation, Phalaris species, and vetch in biosolid experimental plots.

Enhancement specific actions:

1. Map the extent of non-native perennial grasses and then develop a plan to address any problem species.
2. Mow the enhancement area in the fall to reduce woody species.
3. Continue to remove woody species encroaching on the wet prairie.
4. Compost the reed canarygrass windrows.
5. Mow all reed canarygrass on the site prior to seed formation.
6. Install a "beaver baffler" on the eastern remnant channel outfall.

Table 8.2. Progress of the Beaver Run Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Phase 1	Goal Met?	Phase 2	Goal Met?
Site status in the monitoring period	Year 4 of 6	N/A	Year 3 of 5	N/A
Most recent quantitative data collected in year:	PI - 2000	N/A	PI - 2001	N/A
50% native cover after 2 years	61%	Yes	59%	Yes
70% native cover after 5 years	2004	TBD	2004	TBD
75% of those species occurring at a 50% frequency rate or grater shall be from the Native Plant list	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2004	TBD	2004	TBD
Wet Prairie: minimum of 10 native species occurring at 10% frequency rate or greater	2004	TBD	2004	TBD
Emergent: min 5 native species occurring at 10% frequency rate or greater	2004	TBD	2004	TBD

Table 8.3. Progress of the Beaver Run Unit enhancement towards meeting the MIP vegetation standards. The most recent data for the enhancement is compared to its relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 3 of 5	N/A
Most recent quantitative data collected in:	2000	N/A
50% reduction of total shrub cover after 2 years	50%	Yes
50% reduction of tree density after 2 years	86%	Yes
60% reduction of total shrub cover after 5 years	2004	TBD
70% reduction of tree density after 5 years	2004	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits in the 2nd quarter (April-June) and the 4th quarter (Oct.-Dec.). These estimates were made separately for the main Phase 1 restoration area and the Phase 2 restoration area. Water depths were measured monthly at 2 staff gauges.

b) Results

The extent and duration of water at both Phase I and Phase 2 of the Beaver Run Unit appear sufficient for the development of hydric soils and wetland vegetation. Areas of saturation and inundation on remain relatively constant from year to year. The main body of the Beaver Run Unit (Phase 1 and the enhancement) has had consistent levels of inundation and saturation as well. The channel running north to Amazon Creek in the western section of Phase 1 transports runoff from irrigation occurring upstream of the site. This has made conditions within the channel and adjacent areas favorable for the growth of reed canarygrass. Two channels were enhanced to drain the site earlier in the season to allow for treatment of this highly aggressive exotic.

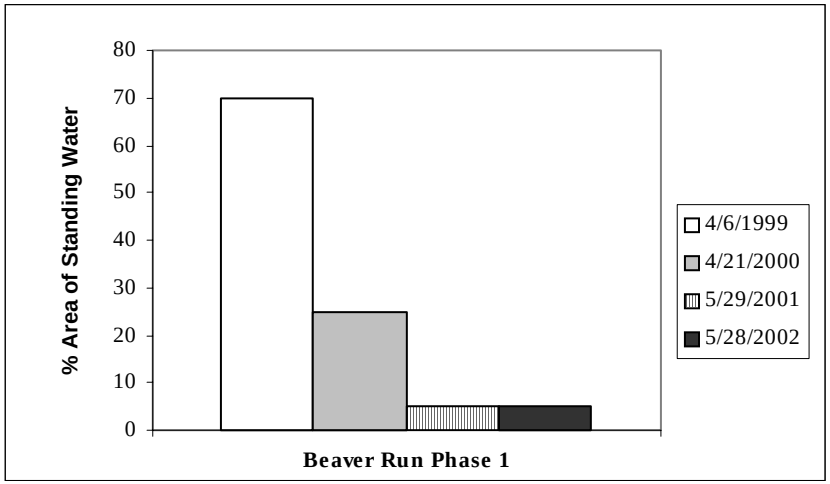


Figure 8.2. Spring standing water in Phase 1 of the Beaver Run Unit. Percentage of Phase 1 with standing water in the early spring over the history of the restoration.

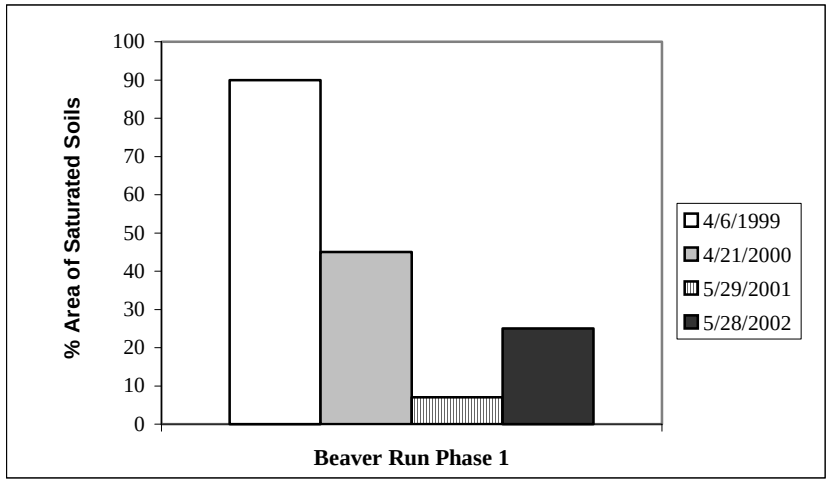


Figure 8.3. Spring saturated soils in Phase 1 of the Beaver Run Unit. Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

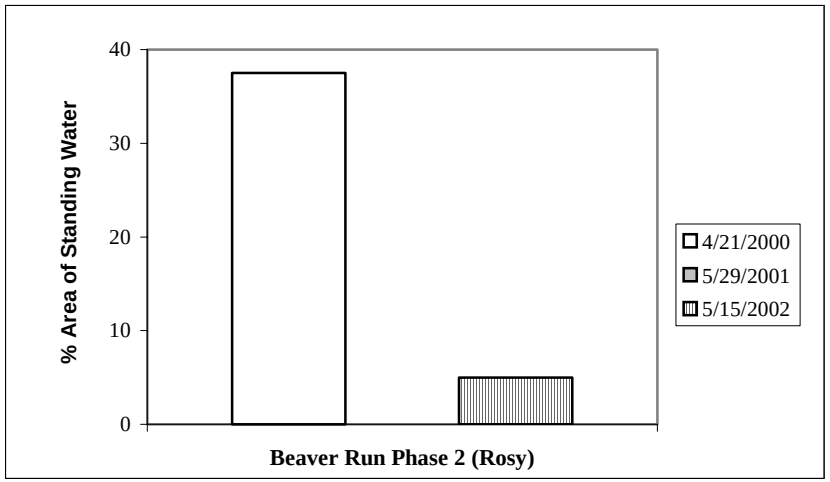


Figure 8.4. Spring standing water in Phase 2 of the Beaver Run Unit. Percentage of Phase 1 with standing water in the early spring over the history of the restoration.

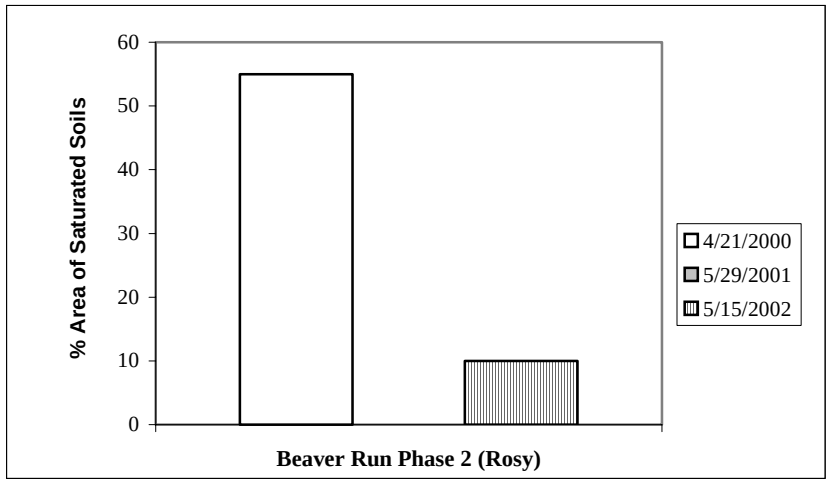


Figure 8.5. Spring saturated soils in Phase 2 of the Beaver Run Unit. Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

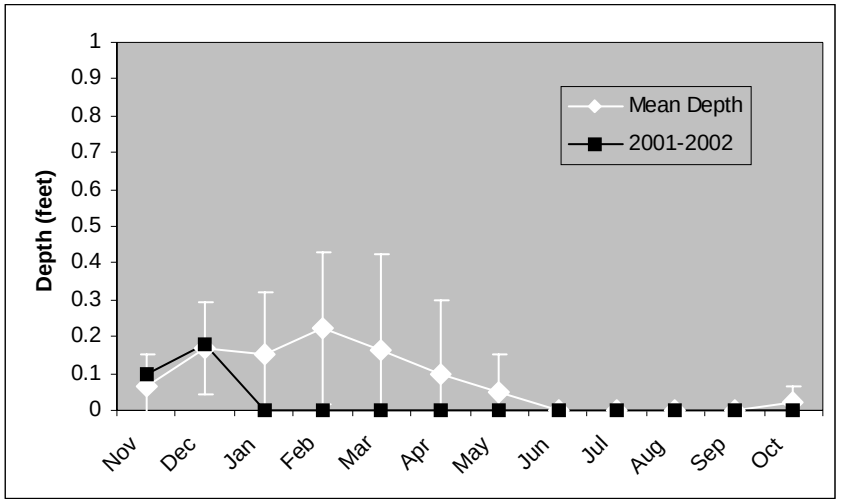


Figure 8.6. Beaver Run Unit—Phase 1 inundation levels in the eastern section during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depths of inundation throughout the year in the eastern emergent area in 2001-2002 are graphed. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed for comparison.

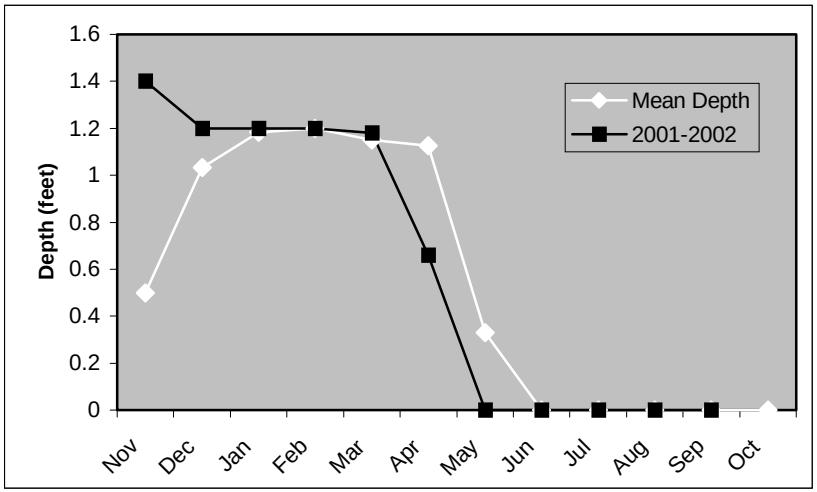


Figure 8.8. Beaver Run Unit—Phase 2 inundation levels in the western section during 2001-2002 compared to the mean depth between 1999 and 2002. Depth of inundation throughout the year in the western vernal pool in 2001-2002. The mean calculated from depths observed between 1998 and 2002 are also graphed for comparison. The standard deviation was not calculated because there are too few data.

2. Vegetation

a) Methods

No quantitative monitoring was scheduled this year on any section of the Beaver Run Unit. Routine qualitative monitoring, such as weed mapping and photopoints, was completed. Point-intercept and nested frequency for the entire site are scheduled for the summer of 2004. Species lists were updated for each section and the results can be viewed in Appendix B.

3. Wildlife Utilization

Historically, many species of wildlife has been observed utilizing this site (see previous Annual Reports). Past sightings included great blue herons, Canadian geese, mallards, orange-crowned warblers, beaver, western pond turtles, and red-winged blackbirds

Chapter 9: Danebo Unit

A. Site Description

1. Size: 10.1 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 9.1**

Section	Years of Construction	Acreage	Monitoring Period
Restoration	1996 and 1997	1.9	1996-2002

4. Location

The Danebo Unit is located on the north side of Amazon Creek between Beltline Rd and Danebo Ave.

5. Site History

Historically the site was used for agricultural purposes. Wetlands on the site were also impacted by the channelization of Amazon Creek.

6. Focus of Prescriptions

Prescriptions focus on restoration (1.9 acres in the western section) and enhancement (remaining acreage in the eastern portion) of emergent and wet prairie communities. Prescriptions were realized through sod removal, installation of a water control structure, and seeding of native species. An additional 0.21 acres of wetland were restored in 1997 in the project area adjacent to the Fern Ridge Bike Path. Hydric soils were exposed to an equivalent elevation as the ground plain of the adjacent wetland.

7. Site-Specific Management Goals

1. Protect and maintain the existing prairie on the east portion of the site, and expand it by removing invading shrubs and blackberry patches.
2. Enhance the existing emergent wetland in the former pasture on the west portion of the site with grading and hydrologic alterations.
3. Expand seasonal emergent wetland communities adjacent to the existing emergent wetland.
4. Provide opportunities to promote research and environmental education.

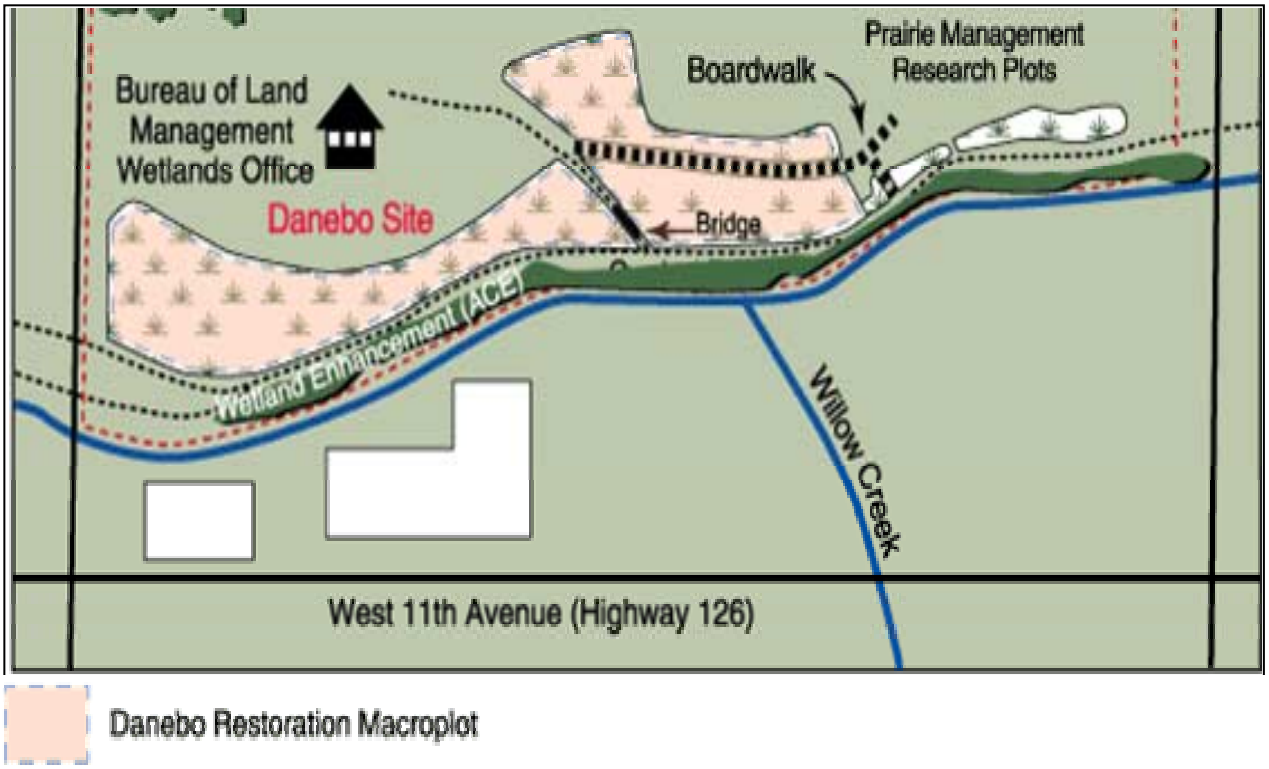


Figure 9.1. Danebo Site Map. The restoration area is labeled with its associated macroplot (shaded peach).

B. 2002 Monitoring Summary

The restoration continues to function as seasonal emergent wetland in its western and central portions and as wet prairie in the east. Hydrologic conditions remain satisfactory for the maintenance and development of hydric soils. The vegetative mitigation bank standards set forth for this site include goals for the total cover and composition of vegetation, the frequency of species and success of the initial seeding. Point-intercept data were collected this year to monitor the site's progress toward the goal for percent cover. These data show that the Danebo Unit is well above this standard. Data collected this summer also show that the Danebo Unit is meeting the vegetation standards. These standards, and the others for which data will be collected next summer, are discussed below with an assessment of Danebo's progress toward meeting each goal.

1. 2002 Management Actions

Entire site: The perimeter of the site was mowed twice, once in the spring and then again in the summer.

Restoration specific actions:

1. Maintenance crews spent three days focusing on pennyroyal removal and an additional day removing a combination of pennyroyal, bentgrass, reed canarygrass, and invasive woody shrubs.
2. Areas where pennyroyal was present with a >50% cover were tilled and then seeded.

Enhancement specific actions:

1. A maintenance crew spent one day removing invasive woody shrubs.

2. Reed canarygrass populations were mowed to prevent seed formation.

2. Management Actions for 2003

Entire site:

The perimeter will be mowed to prevent the spread of exotics along the bike path from invading the restoration and enhancement areas.

Restoration specific actions:

1. To address the population of pennyroyal in the eastern vernal pool, we will:
    a. Hand weed the tilled areas in the vernal pools.
    b. Augment the diversity of the pool with plugs of aggressive native species such as: *Juncus oxymeris, Juncus patens, Carex unilateralis, Agrostsc exarata*, and *Deschampsia cespitosa*.
2. To address the expanding populations of *Agrostis alba*/*tenuis*, *Leontodon nudicaulis*, and *Hypochaeris radicata*, the summer maintenance crew will hand weed the infected areas this spring and summer. Seeding will follow weeding if there is a significant amount of soil disturbance.

Enhancement specific actions:

1. Remove the fence along the eastern edge of the enhancement.
2. Solarize the reed canarygrass on the eastern edge. Follow-up by seeding the area with native species.
3. Continue removal of invasive woody vegetation in the enhancement (i.e., *Rosa multiflora* and *Rosa eglanteria/ multiflora*).

Table 9.2. Progress of the Danebo Unit towards meeting the MOA vegetation standards. The most recent data is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Vegetation Standard in MOA	Site Status in Year 7 (of 8)	Goal Met?
70% native **cover** after 5 years	83%	Yes
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2003	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	29 of 35, or nearly 83%	Yes
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2004	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2004	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits, the first in early spring and the second in late fall. Water depths were measured monthly at 2 staff gauges.

b) Results

Standing water and saturated soils continue to be observed in similar locations on the site. Inundation is deeper in the eastern section of the restoration than in the western. Depths reach up to 2 feet in the eastern section and are kept from getting deeper by a headgate that drains into the Amazon channel. The western pool reached 1.18' last spring. The site continues to display conditions that are sufficient to support hydric soils and wetland vegetation.

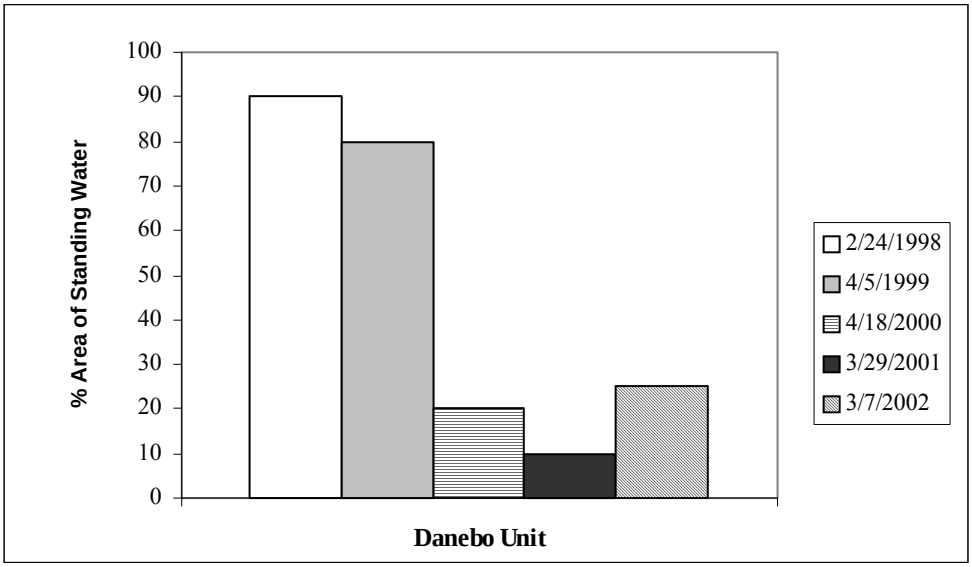


Figure 9.2. Spring standing water in the Danebo Unit. Percentage of the Danebo Unit with standing water in the early spring over the history of the restoration.

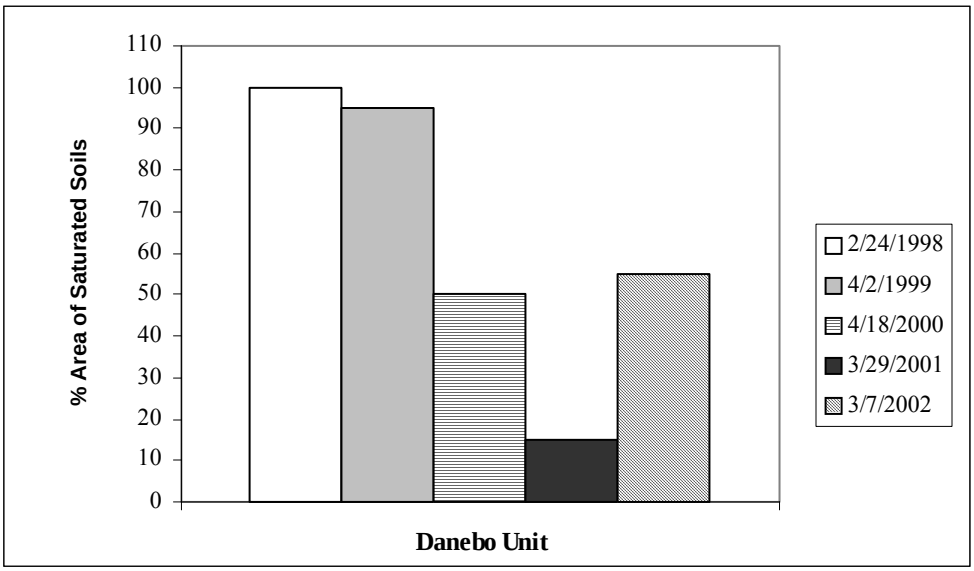


Figure 9.3. Spring saturated soils in the Danebo Unit. Percentage of the Danebo Unit with saturated soils in the early spring over the history of the restoration.

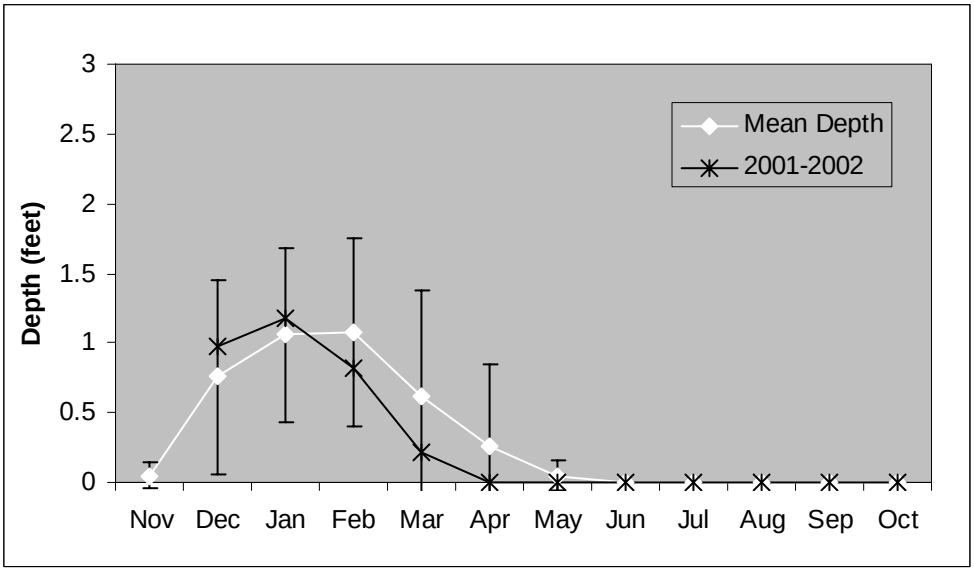


Figure 9.4. Danebo Unit inundation levels in the western section during 2001-2002 compared to the mean and standard deviation of depths between 1997 and 2002. Depth of inundation throughout the year in the western section during 2001 and 2002. The mean and standard deviation calculated from depths observed between 1997 and 2002 are also graphed for comparison.

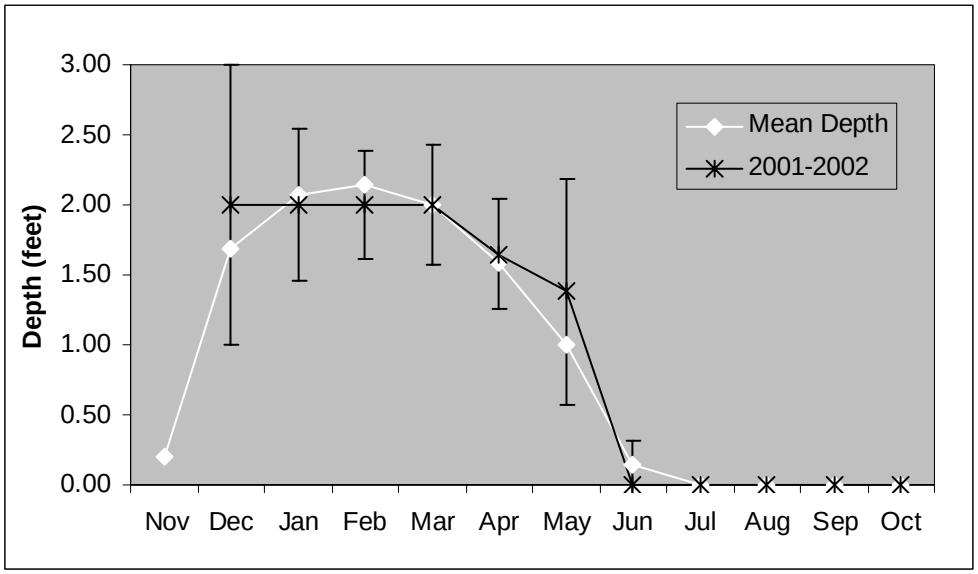


Figure 9.5. Danebo Unit inundation levels in the eastern section during 2001-2002 compared to the mean and standard deviation of depths between 1997 and 2002. Depth of inundation throughout the year in the eastern pool during 2001-2002. The mean and standard deviation calculated from depths observed between 1997 and 2002 are also graphed for comparison.

2. Vegetation

a) Methods

Point-intercept data were collected July 3rd from one macroplot, with a total of 240 points sampled. In addition, a species list was compiled for the entire site and can be viewed in Appendix B. 2002 represented the last year within the 7-year monitoring period for the Danebo restoration project. However, final evaluation of the site will not occur until frequency data is collected in the 2003 field season.

b) Results

Results of point-intercept monitoring indicate that native vegetative cover continues to dominate the site with 83% of the total cover in native species. This is an increase from 67% in 2001. The increased rainfall in 2002 likely helped the three dominant species, *Deschampsia cespitosa*, *Navarretia intertexta*, and *Agrostis exarata*, rebound from their 2001 levels. Additionally, a total of 36 species were detected by point intercept sampling, including 20 natives and 16 introduced species.

Despite the increase in native species cover, the proportion of introduced species on the site has continued to increase since the site's inception, from 15% cover in 1997 to 30% in 2002. However, the increase from 2001 to 2002 was not significant ($\alpha = .10$). Populations of *Leontodon nudicaulis*, *Hypochaeris radicata*, and *Agrostis alba*/*tenuis* contribute heavily to introduced species cover. The *Leontodon nudicaulis* population increased the most from 2001 to 2002, jumping from 2% to 6%.

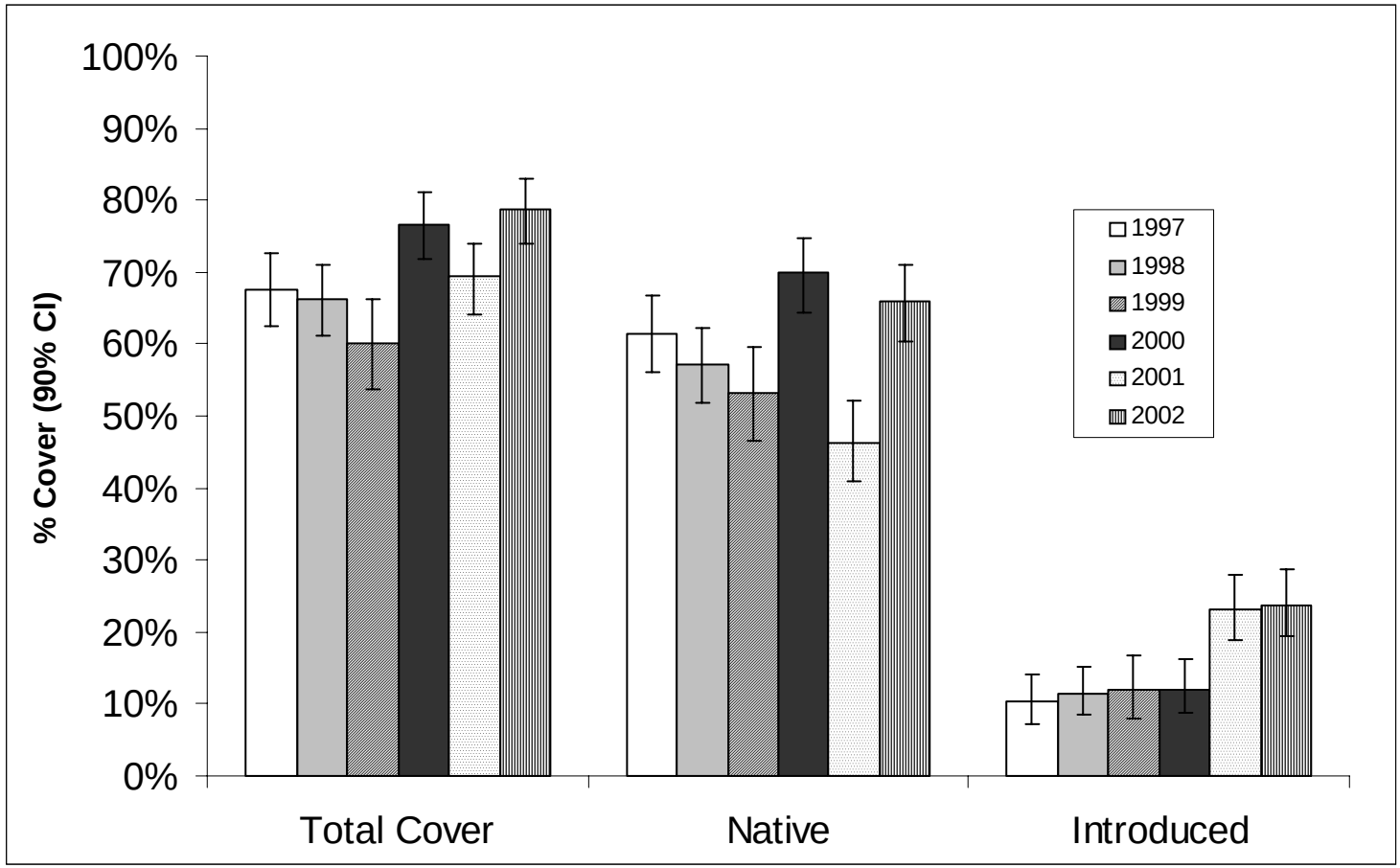


Figure 9.6. Percent cover of ground cover guilds at the Danebo Unit. Total percent cover, native percent cover and introduced percent covers are graphed through time for the Danebo Unit.

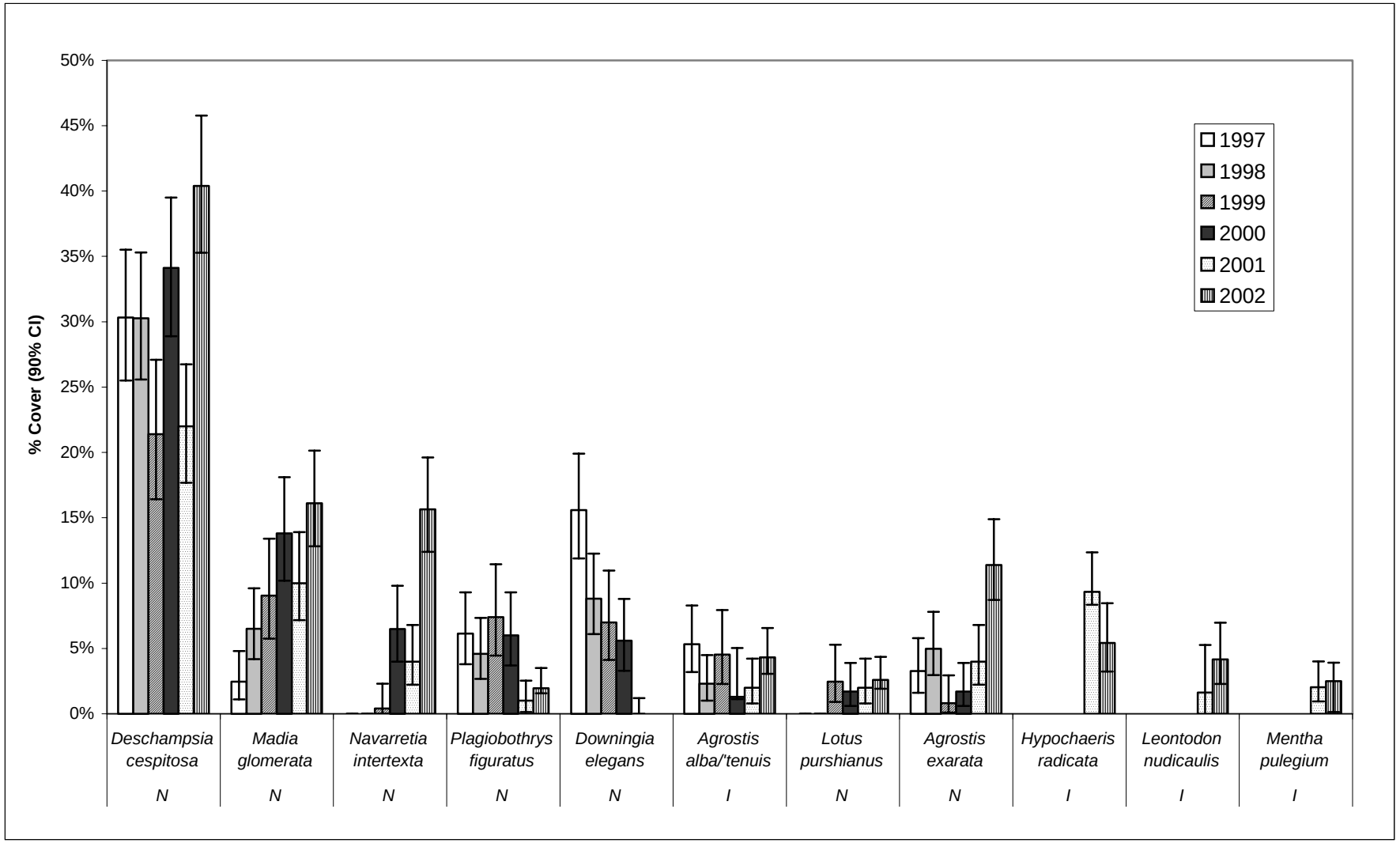


Figure 9.7. Native and introduced species in the Danebo Unit restoration with > 1% cover. All species in 2002 with greater than one percent cover are graphed over the history of the Danebo Unit restoration. Each species name is followed by either and 'N' or and 'I,' indicating whether the species is native or introduced.

3. Wildlife Utilization

Wildlife use appeared similar to previous years (see previous Annual Reports 1998-2001). Great blue herons and mallards remain the most frequent visitors to the site. A mallard nest was present on the site in March 2002, but the nest was not successful.

Chapter 10: Isabelle Unit

A. Site Description

1. Size: 6.0 acres

2. Ownership: BLM

3. Site Timeline: **Table 10.1**

Section	Construction Years	Acreage	Monitoring Period
Enhancement	1997 & 1998	2.37	1999-2003
Restoration	1997 & 1998	1.60	1999-2003

4. Location

The Isabelle Unit is located at the eastern end of Isabelle Rd. It is bordered to the east by Beltline Road, to the south by the Danebo Unit and to the north by West Lawn cemetery.

5. Baseline Conditions

2.37 acres of the Unit remained as wetland prior to implementation of prescriptions in 1997. 1.60 acres of the historic wetland were filled during the development of Isabelle Street. Prior to development of the industrial park, the site was utilized for agricultural purposes

6. Focus of Prescriptions

To restore, enhance and create wet prairie. Prescriptions focused on extraction and removal of fill material. Excavation restored the grade to the original hydric soil. Non-native woody vegetation was cleared from the existing wet prairie, exposed soils were seeded with native prairie grasses and forbs, and the perimeter of the restoration area was seeded with a native upland prairie mix and will be planted with native oak and ash. This perimeter planting will functionally as a buffer from the adjacent industrial park to the west and from Beltline Rd to the east.

7. Site-Specific Management Goals

1. Remove fill (previously placed in wetlands) down to the original hydric soil surface.
2. Re-establish the wet prairie community in areas where fill is removed.
3. Enhance the existing wet prairie community by removing invasive non-native and woody vegetation.
4. Utilize the southwestern portion of the site for a camas salvage experiment. Fill was first removed from the area. Native hydric soil with camas bulbs was removed from a development site was then spread over this area.

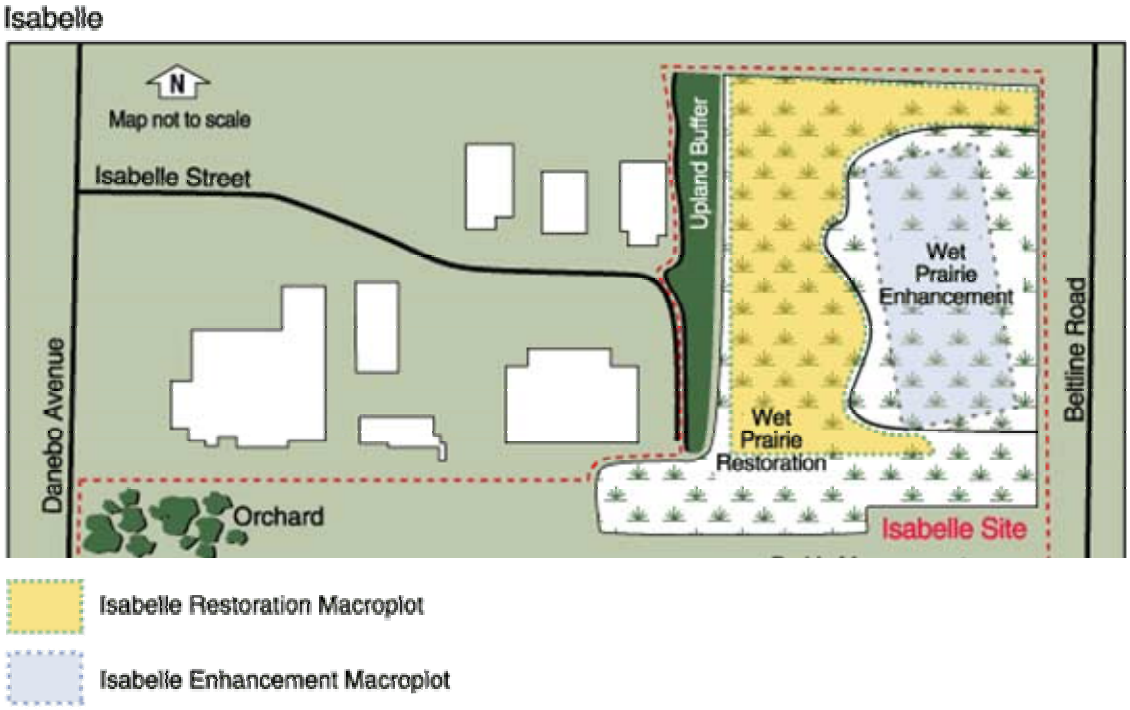


Figure 10.1. Isabelle Site Map. The map shows the Enhancement and Restoration areas labeled with their associated macroplots.

B. 2002 Monitoring Summary

Both the enhancement and restoration areas have sufficient hydrology to support the development of hydric soils and native hydrophytic vegetation. Each area, however, poses its own challenges with the establishment and/or maintenance of native vegetation. While yearly mowing of the Enhancement area appears sufficient to meet mitigation goals for woody vegetation removal, the site is still threatened by non-native species, particularly perennial grasses. And while the restoration area was able to meet fifth year cover standards in the second year, the site continues to contain a large amount of bare ground and is fairly low in diversity. The large number of plugs planted this fall should help to alleviate this problem.

1. 2002 Management Actions

Restoration:

1. A maintenance crew spent one day removing scots broom and two days hand pulling exotics.
2. The Lane Metro Youth Corp. spent one day planting plugs of western witchgrass (*Panicum occidentale*), barestem desert-parsley plugs (*Lomatium nudicaule*), smooth lasthenia (*Lasthenia glaberrima*), wooly sunflower (*Eriophyllum lanatum*), showy milkweed (*Asclepias speciosa*), slender cinquefoil (*Potentilla gracilis*), and bigleaf lupine (*Lupinus polyphyllus*). Most of these plugs were less than 1 inch high and had varying degrees of root development. Most species were planted to add to the nectar sources of the site. All species were planted in the northwestern portion of the site.
3. A youth crew spent one day planting bulbs of common camas (*Camassia quamash ssp. maxima*) and tall camas (*Camassia leichtlinii*). These species were also planted in the northwestern portion of the site.

4. A portion of this site is being used to test the survivability of 6 species of plugs: *Juncus nevadensis, Juncus patens, Camassia quamash ssp. maxima, Sidalcea cusickii, Lomatium nudicaule, Panicum occidentale*. Three plugs of each species were planted in 12 plots that will be monitoring for their success during the next two years.

Enhancement specific actions:

1. A maintenance crew spent one day clipping teasel flower heads.
2. The entire enhancement area was mowed in late fall to suppress woody vegetation growth.

2. Management Actions for 2003

Restoration:

1. Continue yearly hand weeding with special focus on bentgrass, pennyroyal, and scots broom.
2. Treat patches of reed canarygrass and Harding grass by cutting, digging, and/or solarizing.
3. Seed with a diverse perennial forb mixture will be spread to increase cover and diversity.

Enhancement specific actions: Continue to mow the perimeter and entire enhancement area in the Fall.

Table 10.2. Progress of the Isabelle Unit restorations towards meeting the MOA vegetation standards. The most recent data for each section are compared to their relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Restoration	Goal Met?
Site status in the monitoring period	Year 4 of 5	N/A
Most recent quantitative data collected in year:	PI - 2000	N/A
50% native **cover** after 2 years	82%	Yes
70% native **cover** after 5 years	2003	TBD
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2003	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2003	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2003	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2003	TBD

Table 10.3. Progress of the Isabelle Unit enhancement towards meeting the MIP vegetation standards. The most recent data for the enhancement are compared to their relevant vegetation standards from the MIP. A date in the cell indicates the year in which the data will be collected to

evaluate the site's success in meeting the associated standard. 'LI' refers to point-intercept cover data collection.

Site Characteristics and MIP Vegetation Standards	Enhancement Area	Goal Met?
Site status in the monitoring period	Year 4 of 5	N/A
Most recent quantitative data collected in:	LI - 2001	N/A
60% reduction of total shrub cover after 5 years	2003	TBD
70% reduction of tree density after 5 years	2003	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during site visits in early spring. Water depths were measured periodically at a staff gauge.

b) Results

The hydrology at Isabelle remains fairly constant, fluctuating only with changes in the amount of precipitation received from year to year. The restoration area always holds considerably more water, with large pools up to 6 inches deep, than the enhancement area, which has mostly saturated soils. However, both the restoration and the enhancement area contain enough water, in duration and timing, to support the development of hydric soils and hydrophytic vegetation.

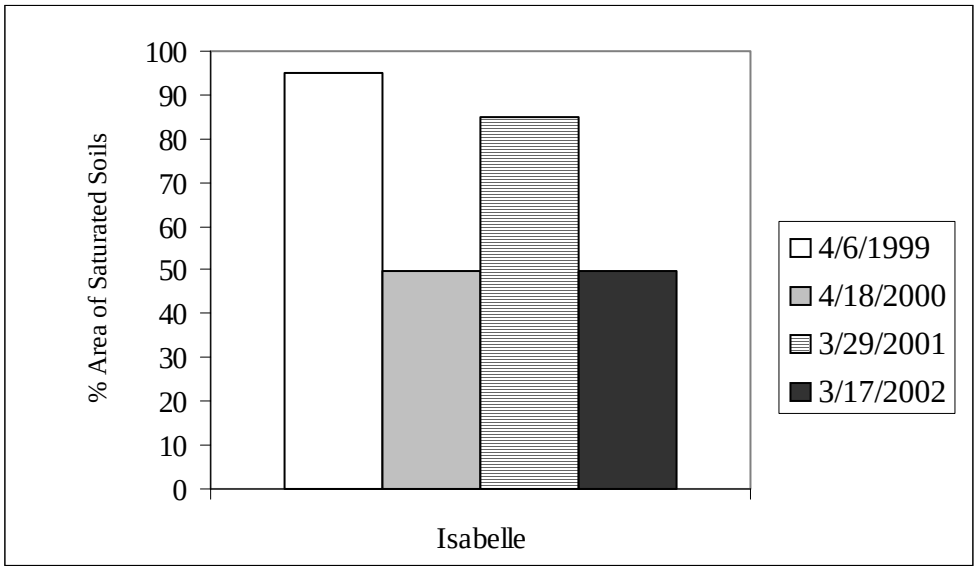


Figure 10.2. Spring standing water in the Isabelle Unit. Percentage of the Isabelle Unit with standing water in the early spring over the history of the restoration.

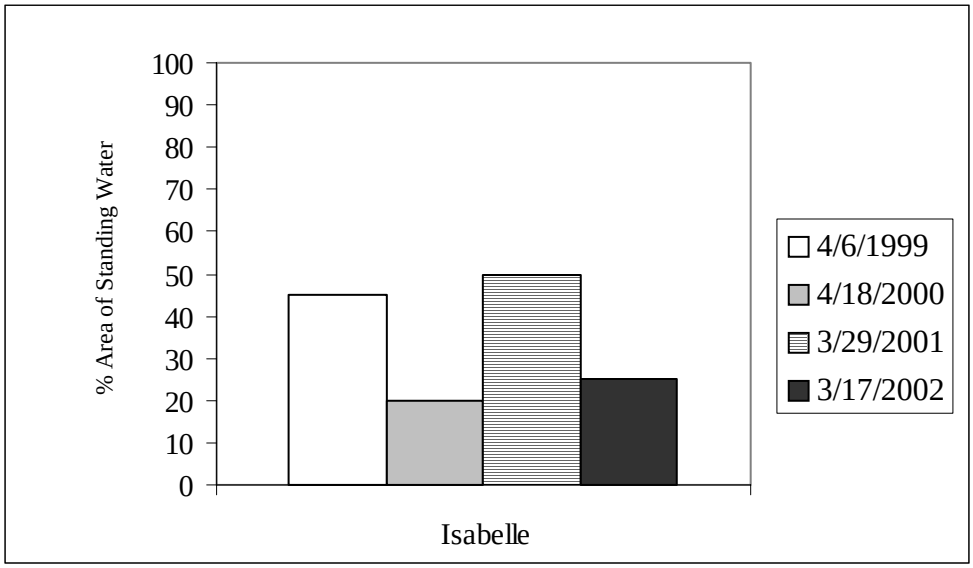


Figure 10.3. Spring saturated soils in the Isabelle Unit. Percentage of the Isabelle Unit with saturated soils in the early spring over the history of the restoration.

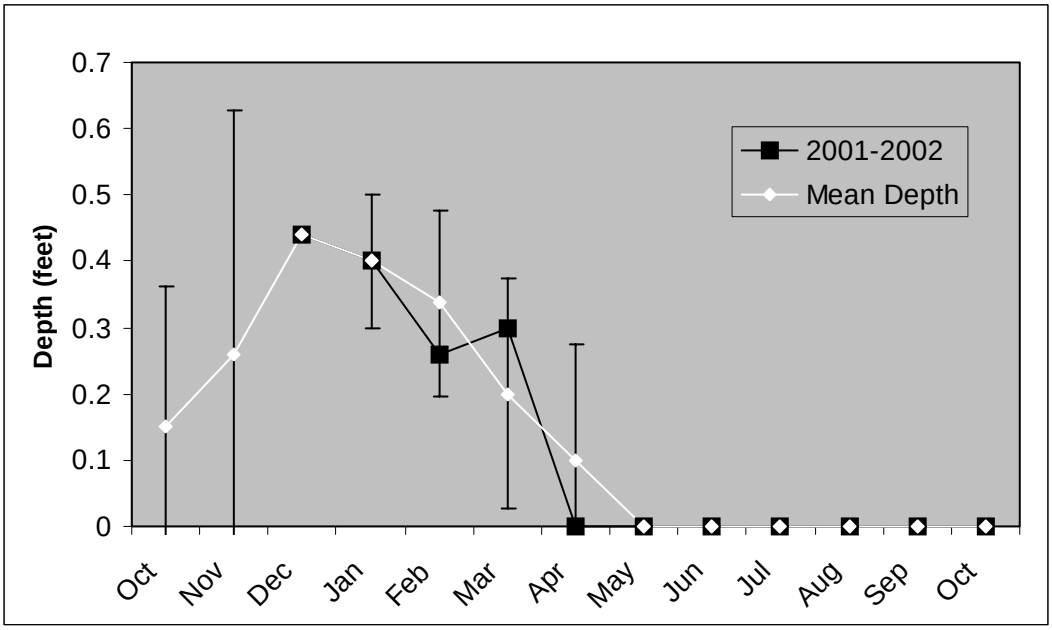


Figure 10.4. Isabelle Restoration inundation levels in the southwestern section during 2001-2002 compared to the mean and standard deviation of depths between 1999 and 2002. Depth of inundation throughout the year in 2001-2002. The mean and standard deviation calculated from depths observed between 1999 and 2002 are also graphed.

2. Vegetation

a) Methods

No quantitative monitoring was completed this year on any section of the Isabelle Unit. Point-intercept and nested frequency for the entire site are scheduled for the summer of 2003. Species lists were updated for each section and can be viewed in Appendix B.

3. Wildlife Utilization

Sightings were consistent with previous use (See previous Annual Reports). As has been previously noted, wildlife use of the site appears limited, possibly due to its relatively small size and proximity to heavily used roads and adjacent development. In addition, the nearby Amazon Creek channel and riparian zone probably attract many wildlife species away from this site. Despite these limitations, a kestrel (*Falco sparverius*) has been observed hunting on this site.

Chapter 11: Nolan Unit

A. Site Description

1. Size: 16.32 acres

2. Ownership: City of Eugene

3. Site Timeline: **Table 11.1**

Section	Construction Year	Monitoring Period
East	1997	1998-2004
West	1997	1998-2004

4. Location

Former site of the partially developed Nolan Industrial Park, the Unit is situated along the north bank of Amazon Creek, east of Beltline Road, and south of 7th Street.

5. Site History

The site was farmed through the late 1970's. In 1980, urban infrastructure was extended to the site. The site was to be developed as an industrial park.

6. Focus of Prescriptions

Restoration and enhancement of wetland prairie and emergent wetland communities. Restoration and enhancement of the wetland was realized through the excavation and removal of fill material, grading and scarifying hydric soils and the installation of water control structures to regulate site hydrology. The site was seeded with native plant species.

7. Site-Specific Management Goals

1. Preserve, enhance, and restore wetlands adjacent to Amazon Creek.
2. Remove fill (previously placed in wetlands) down to the original hydric soil surface, and restore with native emergent wetland vegetation.
3. Enhance existing wetlands by eliminating reed canarygrass from the site.

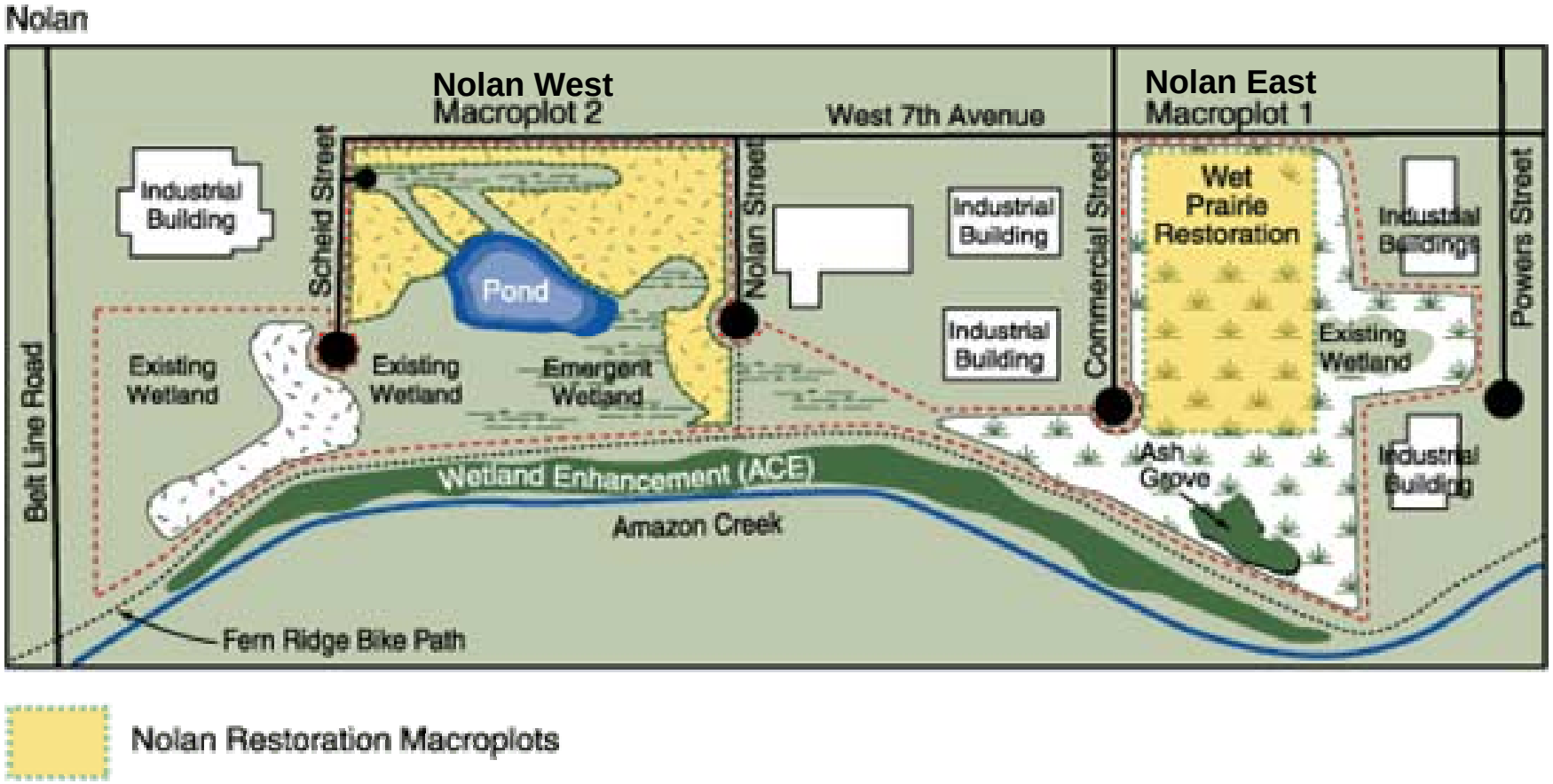


Figure 11.1. Nolan Unit Site Map. Nolan East and Nolan West restorations are labeled with their associated macroplots.

B. 2002 Monitoring Summary

This year was the 5th of the 7 year monitoring period for the Nolan Unit. Both the eastern and western sections continue to demonstrate wetland hydrology sufficient to support the development of wetland soils and vegetation. However, only Nolan West met the 5th year performance standard of greater than 70% cover of native vegetation. An explosion of the pennyroyal population threats Nolan West, but to date, it is controlled and does not appear to detrimentally impact native species diversity on the site. Nolan East had a native species cover of 63% in 2002. With the pennyroyal population at 33% cover and only 17 native species being detected by point-intercept sampling (compared to 28 found in Nolan West), remedial action became necessary (see Management Actions Taken in 2002 for further detail)

1. 2002 Management Actions

Nolan East:

1. Reed canarygrass and Harding grass were mowed in the early spring and fall to prevent flowering.
2. The northern two-thirds of the site was sprayed with herbicide and then tilled to eliminate pennyroyal.
3. Maintenance crews hand pulled bull thistle, Canadian thistle, reed canarygrass, pennyroyal and teasel from the site.

Nolan West:

1. Patches of reed canarygrass and Harding grass were mowed or the seedheads were cut over the whole site.
2. Maintenance crews also spent part of one day removing teasel and thistles.
3. Pennyroyal was pulled from the vernal pools where its density was low.
4. The perimeter was mowed.
5. Dense pennyroyal patches were tilled to retard the plant's growth and to facilitate weeding in 2003.

2. Management Actions for 2003

Nolan East:

1. On the part that was tilled in 2002, focus maintenance activities on controlling pennyroyal through hand weeding and torching.
2. On the part that was not tilled in 2002, focus on removing reed canarygrass, pennyroyal, and Harding grass.
3. Allow the ash grove along the bike path to extend up to 60' into the site (from the bike path). Allow the ash grove to extend eastward and westward as well, as long as it is within the 60' of the bike path. Remove female ash trees from the grove, to keep the expansion of the ash grove to a manageable rate.
4. Continue maintaining the perimeter through mowing and removal of Harding grass populations.

Nolan West:

Redesign and maintain the section east of the Nolan St. by:

1. Develop a plan this winter to re-grade the lot to create a mixture of wet and upland prairie.
2. Plant wet prairie with a low-diversity, highly aggressive mix.
3. Work on locating sites and or growers from which to obtain upland seed. If unavailable, use wetland species that tolerate dryer habitats. (ex. *Danthonia californica, Lotus purshianus, Madia* spp., *Elymus glaucus, Bromus carinatus* and *B. sitchensis, Spiraea douglasii, Lupinus rivularis* and *L. polyphyllus*)

West of Nolan St. and East of Scheid St.:

1. Continue to mow the perimeter and weedy areas.
2. Hand weed the entire site, focusing on vernal pools and tilled areas.
3. Hand dig blackberry crowns and pull invasive rose species.

South and west of Scheid St. (south of the Home Comfort building):

Remove Nolan Industrial Park sign and the fill mound on which it sits.

Table 11.2. Progress of the Nolan Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Site Characteristics and MOA Vegetation Standards	Nolan East	Goal Met?	Nolan West	Goal Met?
Site status in the monitoring period	Year 5 of 7	N/A	Year 5 of 7	N/A
Most recent quantitative data collected in:	PI - 2002	N/A	PI - 2002	N/A
70% native cover after 5 years	63.4%	No	78.7%	Yes
75% of those species occurring at a 50% frequency rate or grater shall be from the Native Plant list	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the seven year monitoring period	2004	TBD	2004	2004
Wet Prairie: minimum of 10 native species occurring at 10% frequency rate or greater	2004	TBD	2004	2004
Emergent: minimum of 5 native species occurring at 10% frequency rate or greater	2004	TBD	2004	2004

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits, the first in early spring and the second in late fall. Water depths were measured monthly at 2 staff gauges.

b) Results

Both Nolan East and Nolan West have hydrology sufficient for the development of hydric soils and hydrophytic vegetation. Nolan East showed no significant changes in hydrology. Inundation at Nolan West increased a great deal, from a previous maximum of 1.5 feet to 1.9 feet this year, showing the results of fall of 2000 management activities. The main vernal pool was deepened in an effort to control the spread of pennyroyal. Outside the excavation area, the hydrology was similar to the hydrology in previous years.

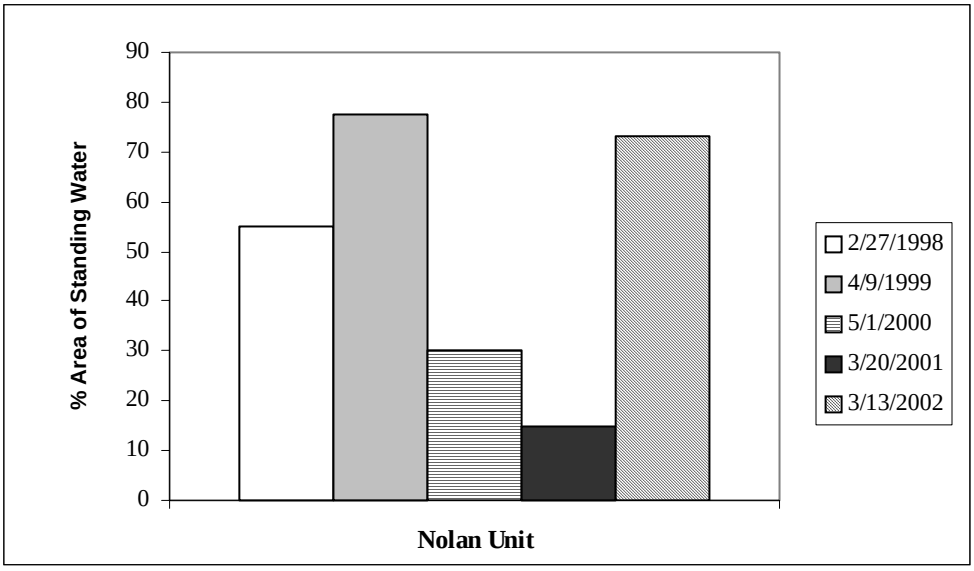


Figure 11.2. Spring standing water in the Nolan Unit. Percentage of the Nolan Unit with standing water in the early spring over the history of the restoration.

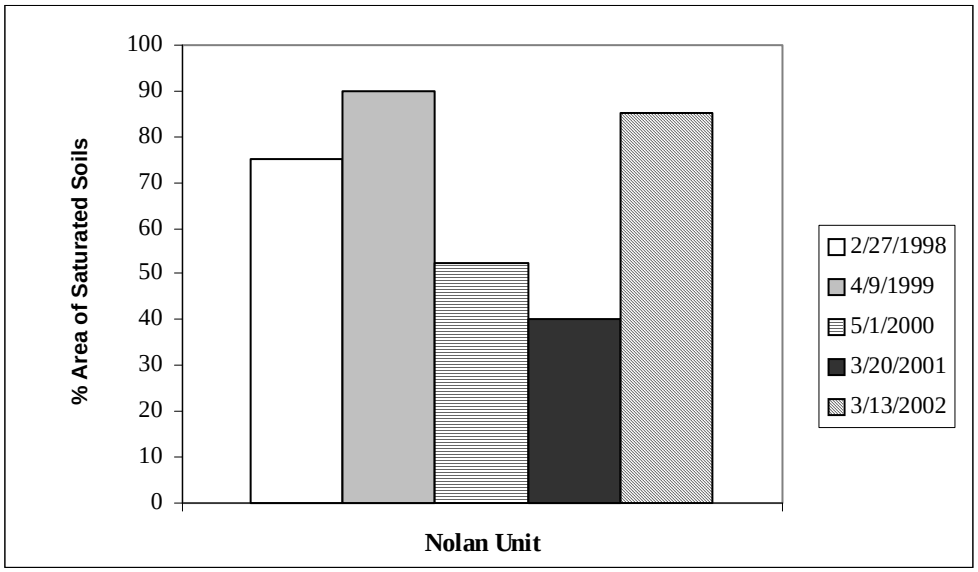


Figure 11.3. Spring saturated soils in the Nolan Unit. Percentage of the Nolan Unit with saturated soils in the early spring over the history of the restoration.

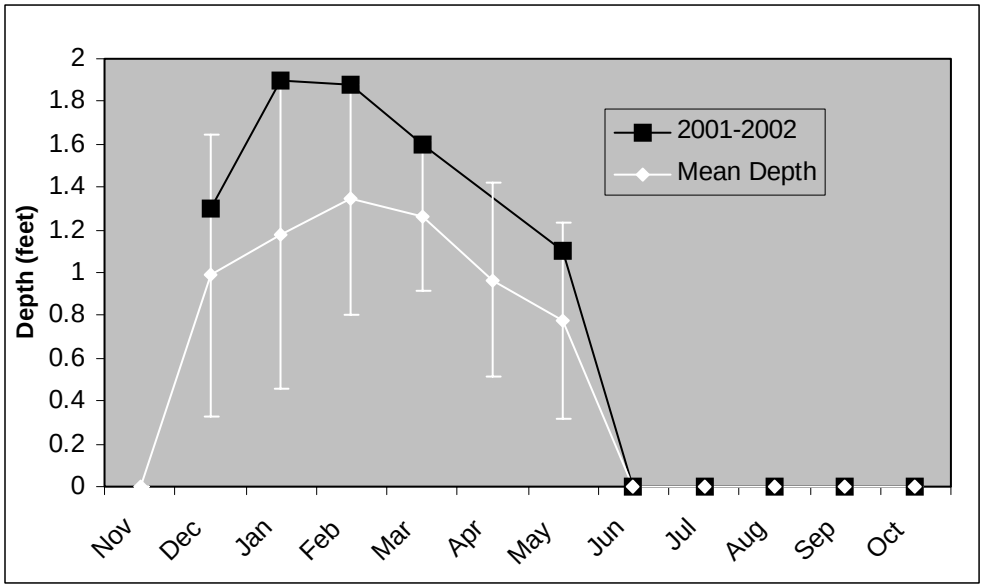


Figure 11.4. Nolan Unit inundation levels in the western section during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depth of inundation throughout the year in the eastern in 2001-2002. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed for comparison.

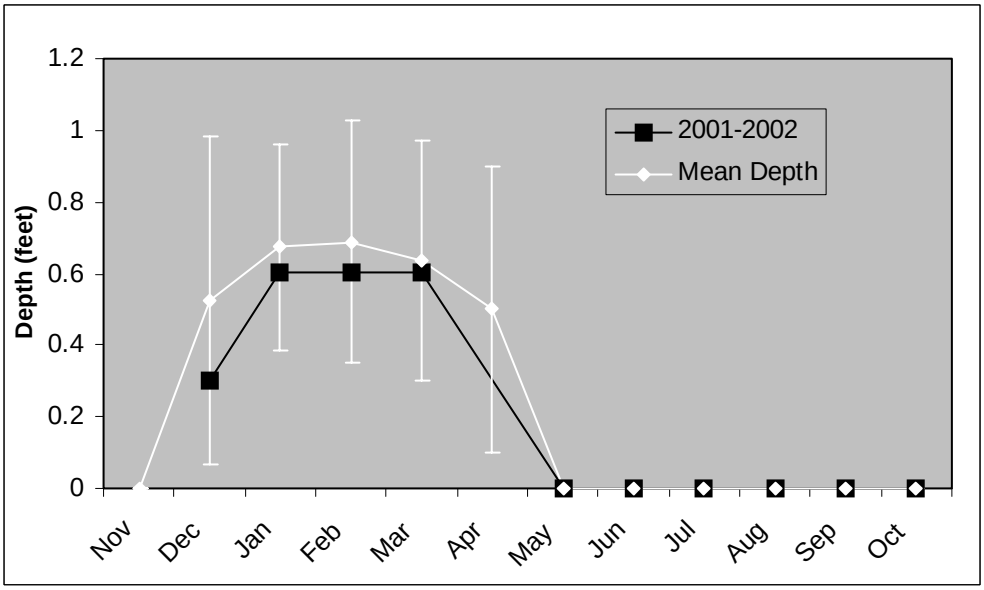


Figure 11.5. Nolan Unit inundation levels in the eastern section during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depth of inundation throughout the year in the eastern in 2001-2002. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed for comparison.

2. Vegetation

a) Methods

Point-intercept data were collected June 4th from Nolan East (223 points sampled) and June 5th and 20th from Nolan West (251 points sampled). In addition, a species list was compiled for the entire site (See Appendix B for the results).

b) Results

Point-Intercept Results for Nolan East:

The eastern section of Nolan did not meet the 5th year mitigation standard of 70% native vegetation. This year, 63% of the total vegetative cover was native. Development of native hydrophytic vegetation has been hindered by the invasion of *Mentha pulegium*. It was the 33% cover of pennyroyal that prompted the remedial actions this summer of spraying, tilling, and seeding the affected areas.

Point-Intercept Results for Nolan West:

The western section of Nolan did meet the 5th year mitigation standard of 70% native vegetation, with a native percent cover of 78%. With a 14% cover of *Mentha pulegium*, the species may still threaten the long-term success of the restoration, but it is still at relatively controllable level. Native species diversity Nolan West continues to be high, with a total of 28 native species being detected by point-intercept sampling.

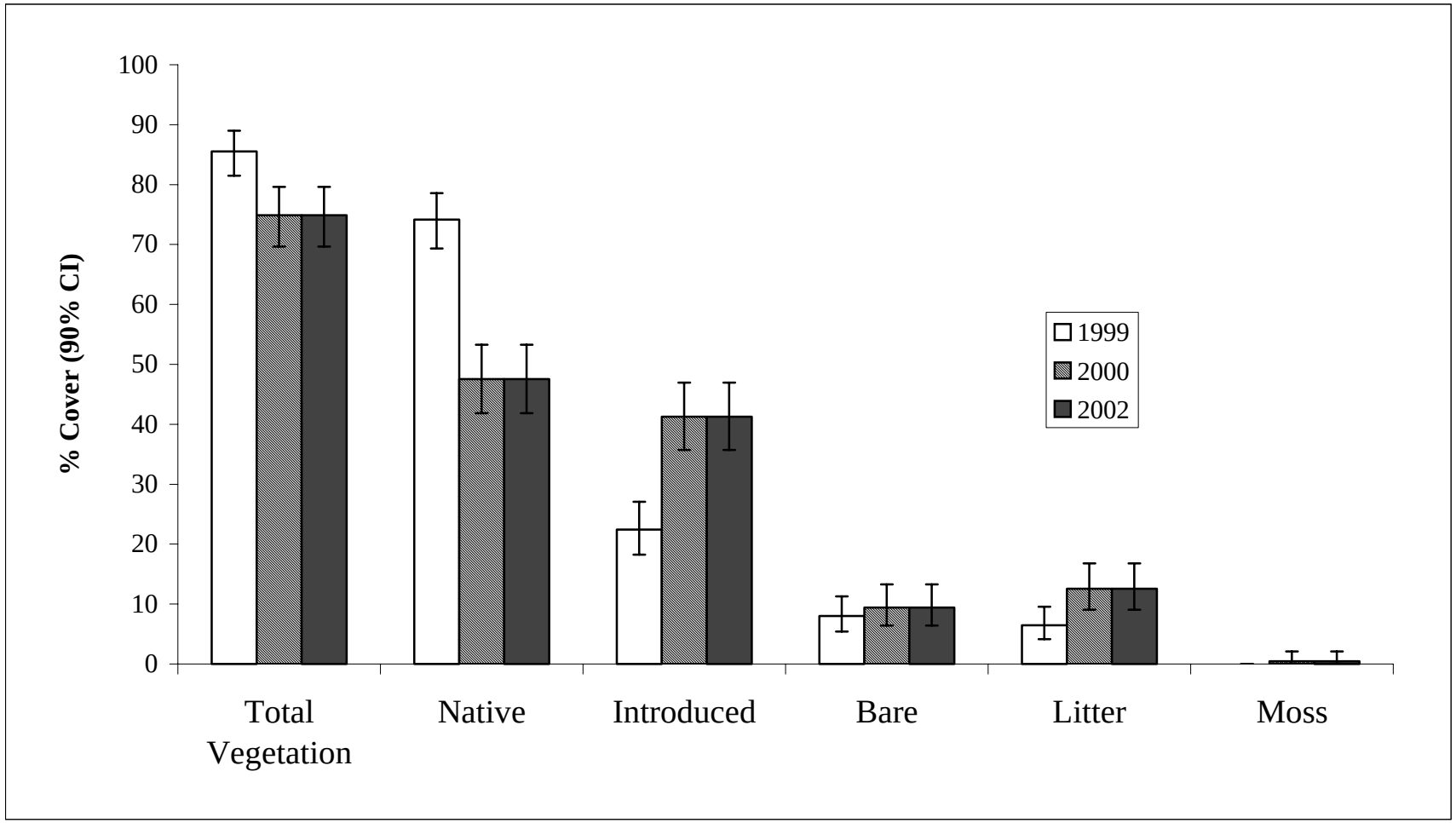


Figure 11.6. Percent cover of ground cover guilds in the eastern section of Nolan. Total percent cover of all species, native species, introduced species, bare ground, litter and moss are graphed for 1999, 2000 and 2002 for the Nolan's eastern section.

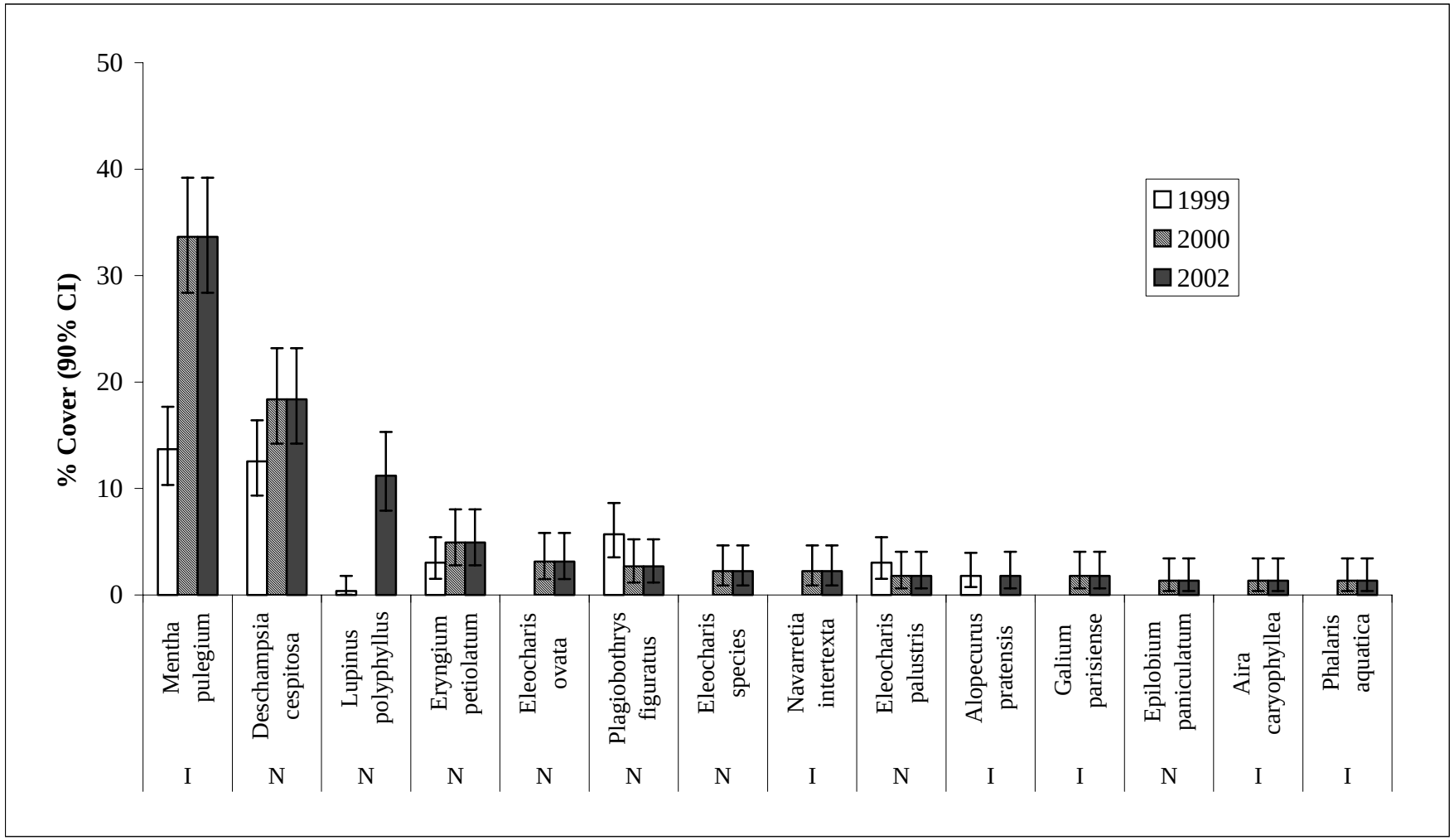


Figure 11.7. Native and introduced species in the eastern section of Nolan restoration with > 1% cover. All species in 2002 with greater than one percent cover are graphed over the history of Nolan's eastern section. Each species is followed by either an 'N' or an 'I' indicating whether the species is native or introduced.

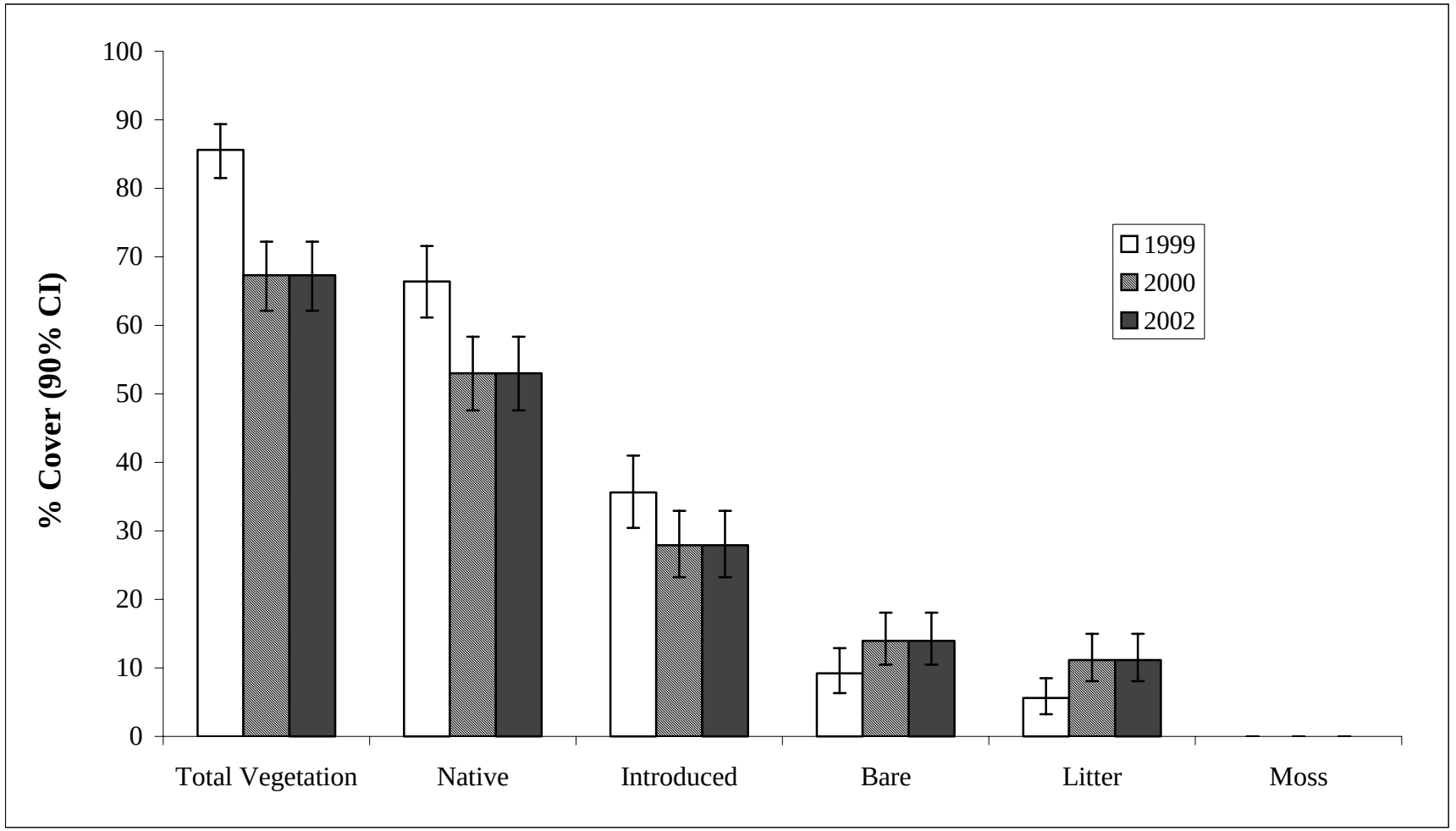


Figure 11.8. Percent cover of ground cover guilds in the western section of Nolan. Total percent cover of all species, native species, introduced species, bare ground, litter and moss are graphed for 1999, 2000 and 2002 for the Nolan's western section.

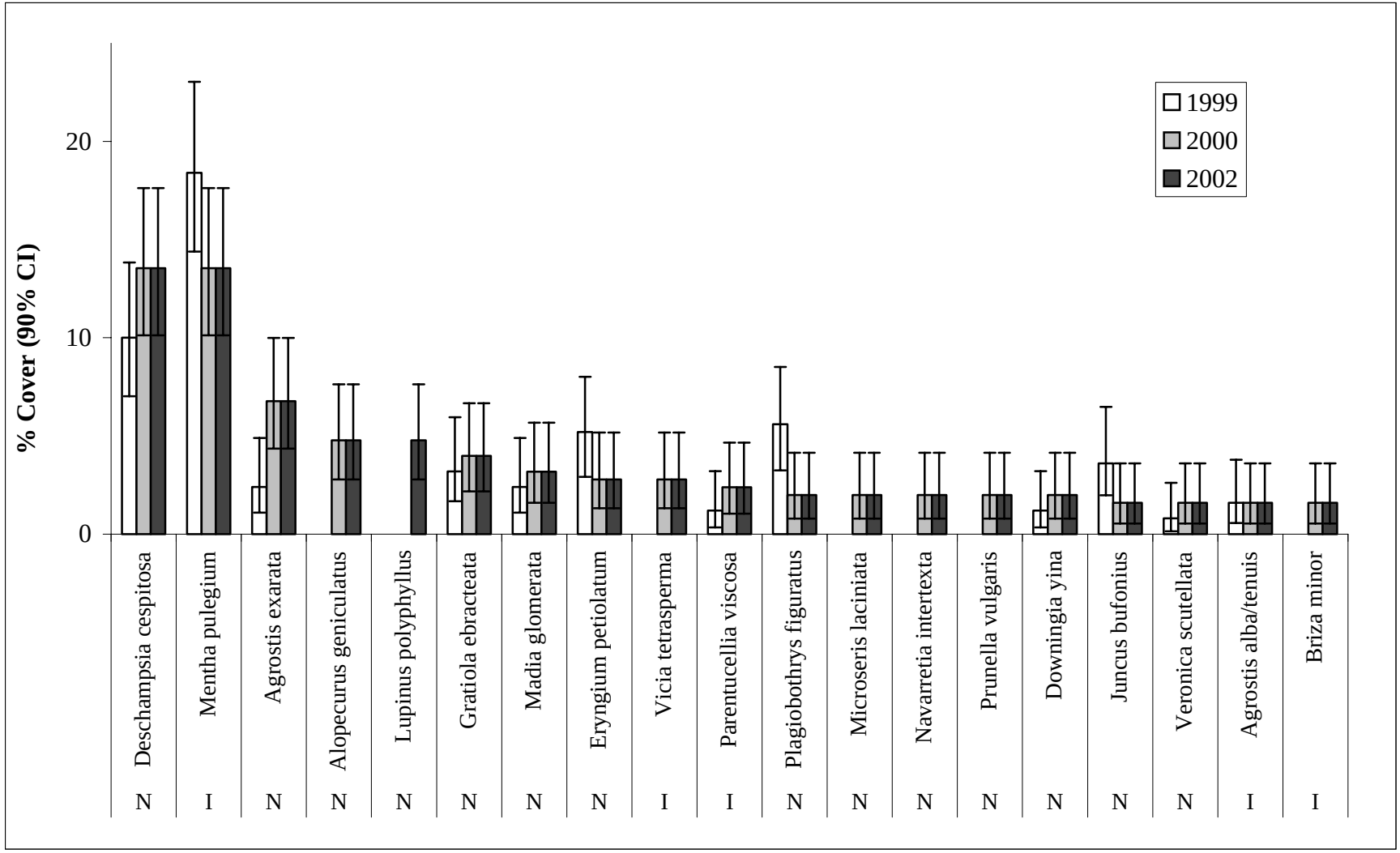


Figure 11.9. Native and introduced species in the western section of Nolan restoration with > 2% cover. All species in 2002 with greater than one percent cover are graphed over the history of Nolan's western section. Each species is followed by either an 'N' or an 'I' indicating whether the species is native or introduced.

3. Wildlife Utilization

Waterfowl are attracted by the seasonal pond and remain the most frequent visitors to the site. Specific sightings for this year include Canada geese, mallards, and ring-necked pheasants.

Chapter 12: North Greenhill Prairie

A. Site Description

1. Size: 71 acres

2. Ownership: BLM

3. Site Timeline: **Table 12.1**

Section	Construction Year/s	Acreage	Monitoring Period
Phase 1 Sod-Removal	1998	12.5 acres	1999-2003
Phase 1 Solarization	1998	1.0 acres	1999-2003
Phase 2 Sod-Removal	2000-2002	7.5 acres	2000-2005
Phase 2 Solarization	2000	0.9 acres	2001-2004
Phase 3 Sod-Removal	2002	19.04 acres	2003-2007

4. Location

The site is located on the west side of Greenhill Road, approximately one half mile south of Royal Avenue and approximately three quarters of a mile north of the Southern Pacific Railroad tracks in Township 17 S., Range 4 W., Section 30, tax lot 2100.

5. Site History

Of the 71 acres, 50.6 acres were delineated as farmed wetland. Sampling indicated that approximately 90% of the vegetation was non-native grasses. From conditions observed in February and March of 1997, it was determined that there were three primary sources of water on the site: precipitation directly on the site, flow from the South Greenhill site, and flow from seeps likely fed by run-off from the east side of Oak Hill. The site was farmed for hay production prior to BLM ownership.

6. Focus of Prescriptions

Restore/enhance native wet prairie and vernal pool communities in the former agricultural lands on the site.

7. Site-Specific Management Goals

1. Restore natural hydrology by dispersing water flows currently confined to ditches into broader surface flows.
2. Restore/enhance native wet prairie and vernal pool communities in the agricultural lands on the site.
3. Restore upland prairie vegetation to the tops of mounds situated within the wetland mitigation area.
4. Enhance habitat conditions for native wildlife species associated with wet prairie and ash savanna habitats.
5. Ensure compatibility of wetlands between this mitigation site and the ODOT mitigation site immediately to the south.
6. Take advantage of the large size of the site to establish large areas of contiguous wetland communities on the site and in conjunction with future wetland restoration on adjacent sites to the east and south.

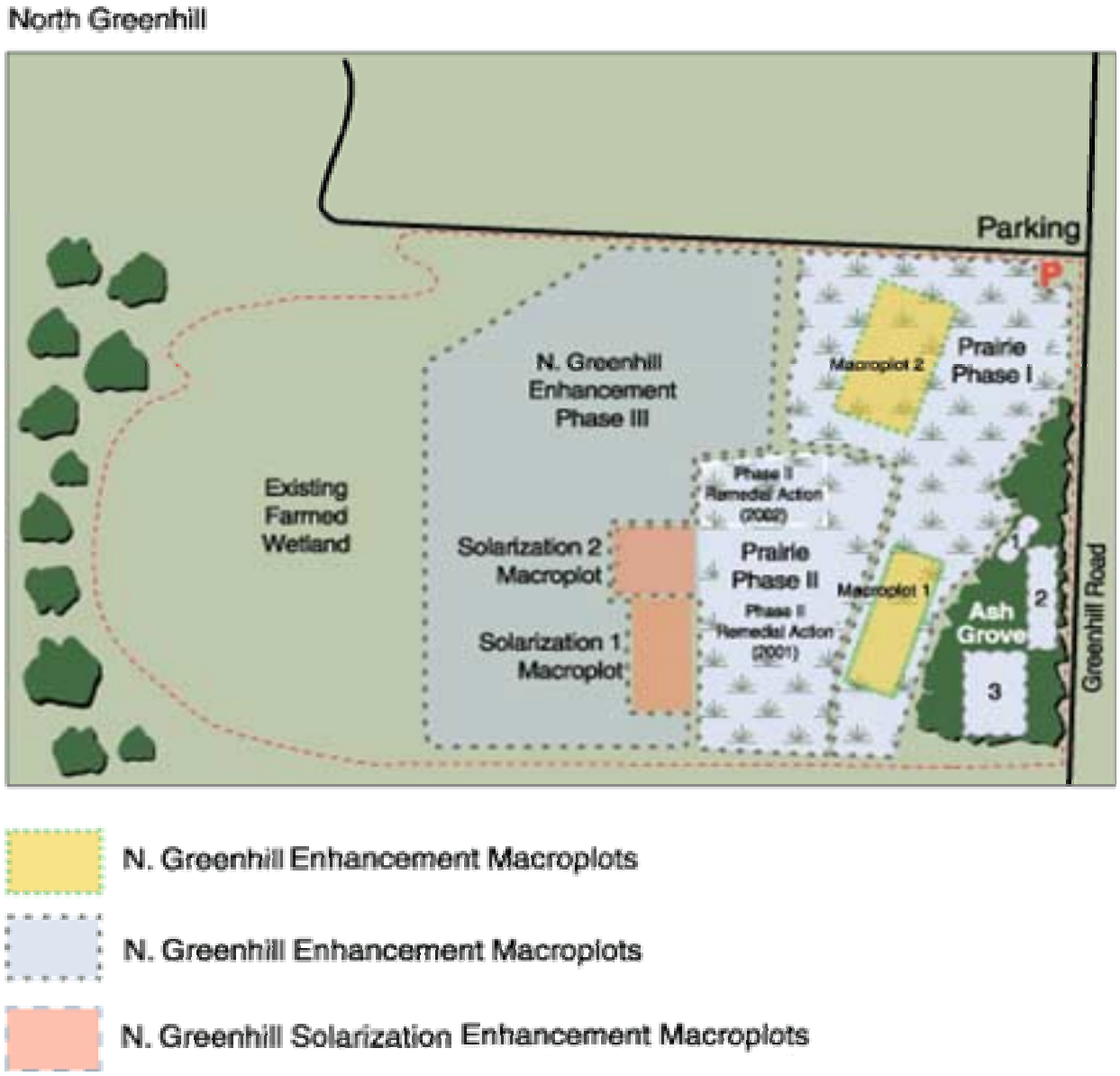


Figure 12.1. North Greenhill Prairie Site Map. The Enhancement Ash Grove area, Phases 1 and 2 sod-removal enhancements, Phases 1 and 2 solarization enhancements, and the Phase 3 enhancement are labeled with their associated macroplots.

B. 2002 Monitoring Summary

All phases of restoration in the North Greenhill Unit are presently meeting vegetation and hydrology standards. However, a change has been detected in the hydrology in the northeastern corner of Phase 1. It appears that the unenhanced ash grove is backing up water into Phase 1. A detailed evaluation of the hydrology will be done this spring to make sure this alteration will not adversely impact the adjacent wetlands. Phase 2 Solarization has met 2nd year vegetation standards, but the high percent cover of invasive species will need to be monitored closely. Invasive species monitoring will continue to be key in assuring the continued success of this site as a whole.

The Phase 2 Sod-Removal was begun in 2000. After the first seed assessment, it was determined that, on the site's present trajectory, the area would not meet 2nd year vegetation standards because many highly invasive species had become establish over much of the area. This may have been in part because the drought of 2000-2001 made the site conditions more favorable to non-native species than native wetland species. In the fall of 2001, more of the seedbank was removed, and the area was then re-seeded. The seeding assessment showed moderate success in the establishment of hydrophytic vegetation. However, the major success with remedial action was not in what species became established, but what did not. The area was much less invaded with exotic species. The invasive species that did return were in small enough amounts to be controlled through mechanical measures.

1. 2002 Management Actions

Phase 1:

1. A maintenance crew spent two days hand weeding the area.
2. The site perimeter was mowed to reduce weed invasion.
3. Pennyroyal populations were hand weeded by a Northwest Youth Corps crew. Additional large populations of pennyroyal were tilled to retard growth and enable hand weeding in 2003.

Phase 2:

1. A maintenance crew spent nine days hand weeding the area.
2. The site perimeter was mowed to reduce weed invasion.

Phase 3:

Phase 3 of the Greenhill Prairie enhancement project was implemented this summer. Non-native agricultural grass sod was removed from a total of 19.04 acres. The site was graded to follow the existing site topography. Special care was taken to integrate the solarizaton plots (associated with Phase 1 and Phase 2 implementation) into the anticipated surface water hydrology. Also, a silt fence was installed on the south property line to separate surface water flows from the adjacent agricultural field to the south. In addition, a 10-foot wide strip of land on the uphill side (west and north edges of Phase 3) was lightly scraped (2-3 inches) to remove some of the sod material and then covered with a woven coconut fiber blanket that filters runoff before it flows on to the new enhancement area. This buffer area (10 foot strip) is not included in the current phase, but is planned to be part of Phase 4 implementation. These measures were taken in an attempt to minimize contaminated run off as a source of weeds (especially non-native grasses) to the newly enhanced area.

The sod layer with some topsoil was removed during Phase 3 construction. The existing pond area was slightly enlarged, enhancing the habitat diversity on the site. This pond is quite shallow (ranging from 8 to 24 inches deep). The area of enlargement wraps around the north and east sides of the existing pond and is approximately the same depth. The source of hydrology for the pond is precipitation and surface flow from a couple of seeps further up hill. The existing upland mound associated with the pond will be planted with upland shrubs and other plant species.

2. Management Actions for 2003

Phase 1:

1. Mow weedy southern perimeter early in the season and as required there after to limit the spread of weed seeds.
2. Continue control of *Mentha pulegium.*
3. Continue hand weeding. Special attention may be given *to Hypochaeris radica, Rubus armeniacus*, and the recent explosions of *Centauria umbellatum, Parentucellia viscosa*, and *Lotus purshianus*
4. Sow supplemental mix of seeds to upland mounds. Mix may include *Danthonia californica* and *Bromus carinatus.*

Phase 2:

1. Continue hand weeding the entire restoration site with particular emphasis on weeds growing along the eastern edge where Phase II adjoins Phase I.

Phase 3:

1. Mow site perimeter and upslope of restoration area (except the upland fill area in the NW corner) early in the season and as required thereafter to limit the spread of weed seeds.
2. Hand weed entire site after doing a seeding assessment.
3. Grub out or mow thistles and blackberry near the pond area late in the season.
4. Monitor/assess effectiveness of weed barrier blankets installed along western edge.
5. Assess weed growth in the upland fill area and take action as necessary.

Table 12.2. Progress of the North Greenhill Unit enhancements towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Site Characteristics and MOA Vegetation Standards	Phase 1				Phase 2				Phase 3	
	Sod-Removal	Goal Met?	Solarization	Goal Met?	Sod-Removal	Goal Met?	Solarization	Goal Met?	Sod-Removal	Goal Met?
Site status in the monitoring period	Year 4 of 5	N/A	Year 4 of 5	N/A	Year 2 of 6	N/A	Year 2 of 5	N/A	Year 0 of 5	N/A
Most recent point-intercept cover data collected in:	2000	N/A	2000	N/A	2003	N/A	2002	N/A	2004	N/A
50% native **cover** after 2 years	MP1 = 54% MP2 = 70%	Yes	77%	Yes	2003	TBD	82%	Yes	2004	TBD
70% native **cover** after 5 years	2003	TBD	2003	TBD	2006	TBD	2005	TBD	2007	TBD
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2003	TBD	2003	TBD	2006	TBD	2005	TBD	2007	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2003	TBD	2003	TBD	2006	TBD	2005	TBD	2007	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2003	TBD	2003	TBD	2006	TBD	2005	TBD	2007	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2003	TBD	2003	TBD	2004	TBD	2005	N/A	2003	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during site visits in early spring for all phases. Water depths were measured periodically at 2 staff gauges in Phase 1.

b) Results

Phase 1

Hydrology mapping seems to indicate a decrease in standing water and saturated soils; however, the more objective staff gauge data appears to indicate a substantial and fairly consistent amount of surface water on the site in the northeast and an increasing amount of surface water in the southeastern portion of the site. Hydrology mapping only captures the amount of soil saturated to the surface of the ground, while saturated soil within 12 inches of the ground indicated wetland hydrology. This area will be monitored more closely this spring to see if hydrology on the site has changed.

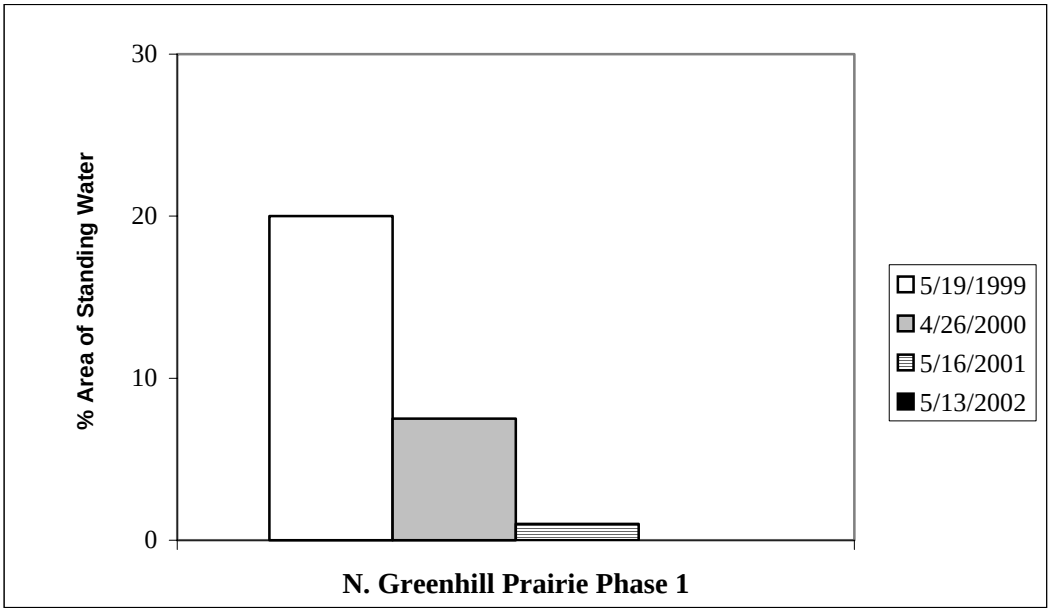


Figure 12.2. Spring standing water in Phase 1 of the N. Greenhill Prairie Unit. Percentage of Phase 1 with standing water in the early spring over the history of the restoration.

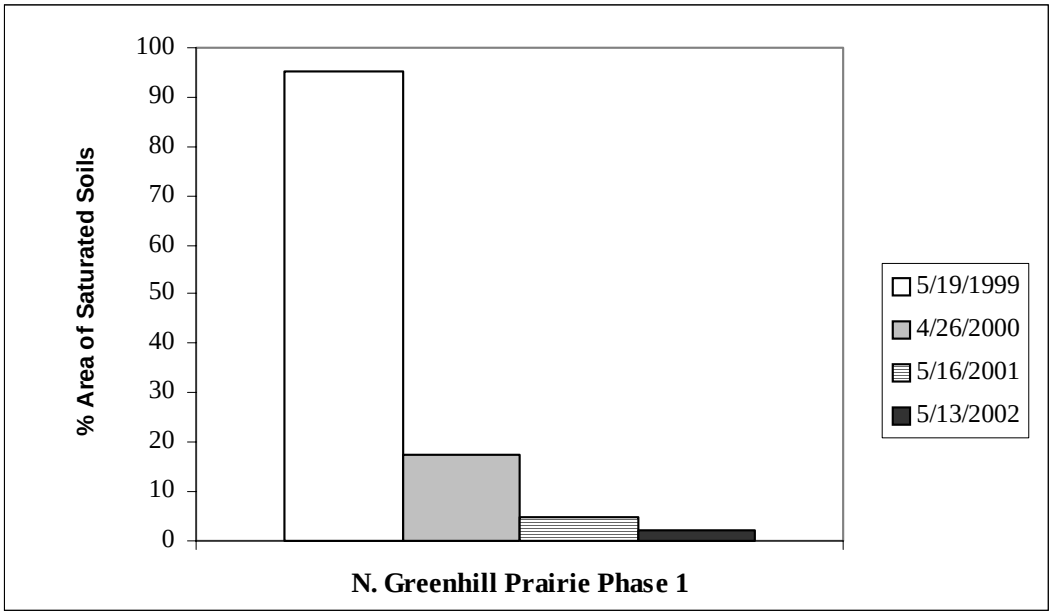


Figure 12.3. Spring saturated soils in Phase 1 of the N. Greenhill Prairie Unit. Percentage of the Phase 1 with saturated soils in the early spring over the history of the restoration.

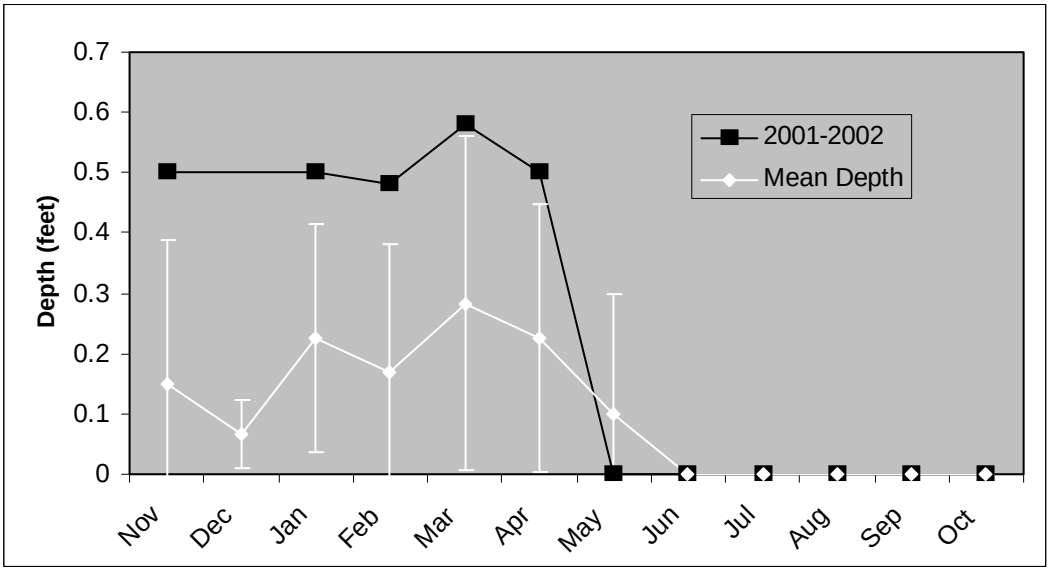


Figure 12.4. N. Greenhill Prairie Unit inundation levels in the northeastern vernal pool during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depth of inundation throughout the year in the northeastern area over 2001-2002. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed for comparison.

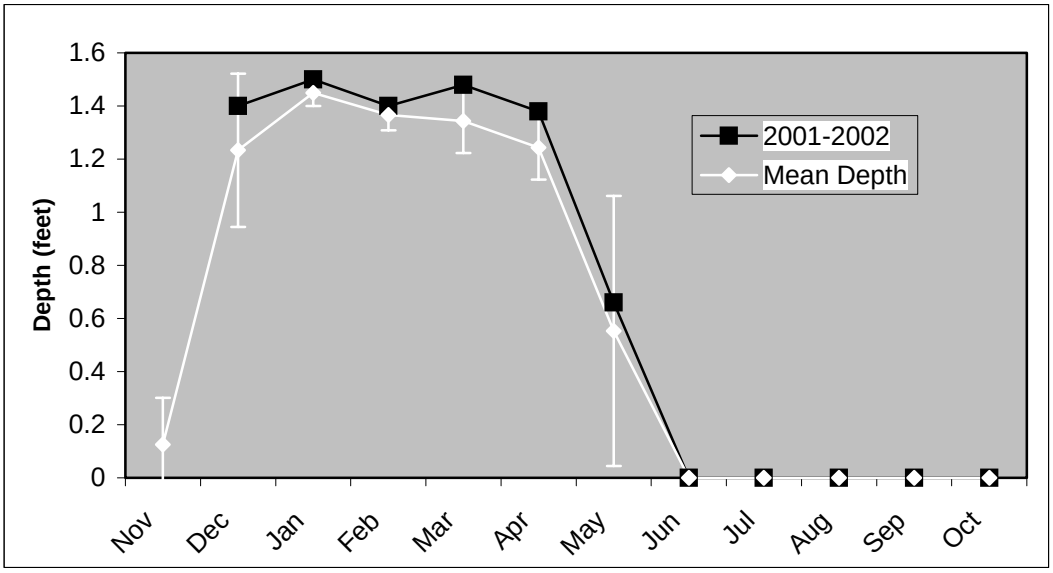


Figure 12.5. N. Greenhill Prairie Unit inundation levels in the southeastern vernal pool during 2001-2002 compared to the mean and standard deviation of depths between 1999 and 2002. Depth of inundation throughout the year in the northeastern emergent area over the history of the restoration. The mean and standard deviation calculated from depths observed between 1999 and 2002 are also graphed for comparison.

Phase 2
No surface saturated soils or surface water were observed on either May 15, 2001 or May 13, 2002. The substantial amount of bare soil and consecutive dry springs (see rainfall graphs in Appendix C) probably contributed to the outcome. This area will be more closely monitoring this spring to determine if wetland hydrology has been achieved.

Phase 3
The first assessment of this section's hydrology will occur in 2003.

2. Vegetation
a) Methods
Point-intercept data in the Phase 2 solarization were the only quantitative vegetation data collected in 2002. These data, 224 points, were collected on June 10. Additionally, a seeding assessment for the sod-removal portion of Phase 2 was done on two occasions. Data were collected on May 22 and June 11. A species list for each phase was also compiled and/or updated and can be viewed in Appendix B.

b) Results
Phase 2 Solarization: Point-intercept Results
The two solarization plots in their second year after planting have a very different species composition than second year sod-removal restorations. The total cover for both trials is above 90%, while most sod-removal restorations have a total cover of around 70%. The total cover of native species for both trials (above 75%) is also higher than most sod-removal restorations, which are usually around 50%. The cover of introduced species is also significantly higher than that of sod-removal restorations. Most sod-

removal restorations have approximately 10-15% cover of introduced species in the second year, while both solarization trials are above 30%. A comparison of the species richness data reveals that the different techniques also differ with respect to the number of natives that can become established. Twenty-one species were established in the solarization trials while restorations 25 or more specie s consistenty establish in sod-removal restorations.

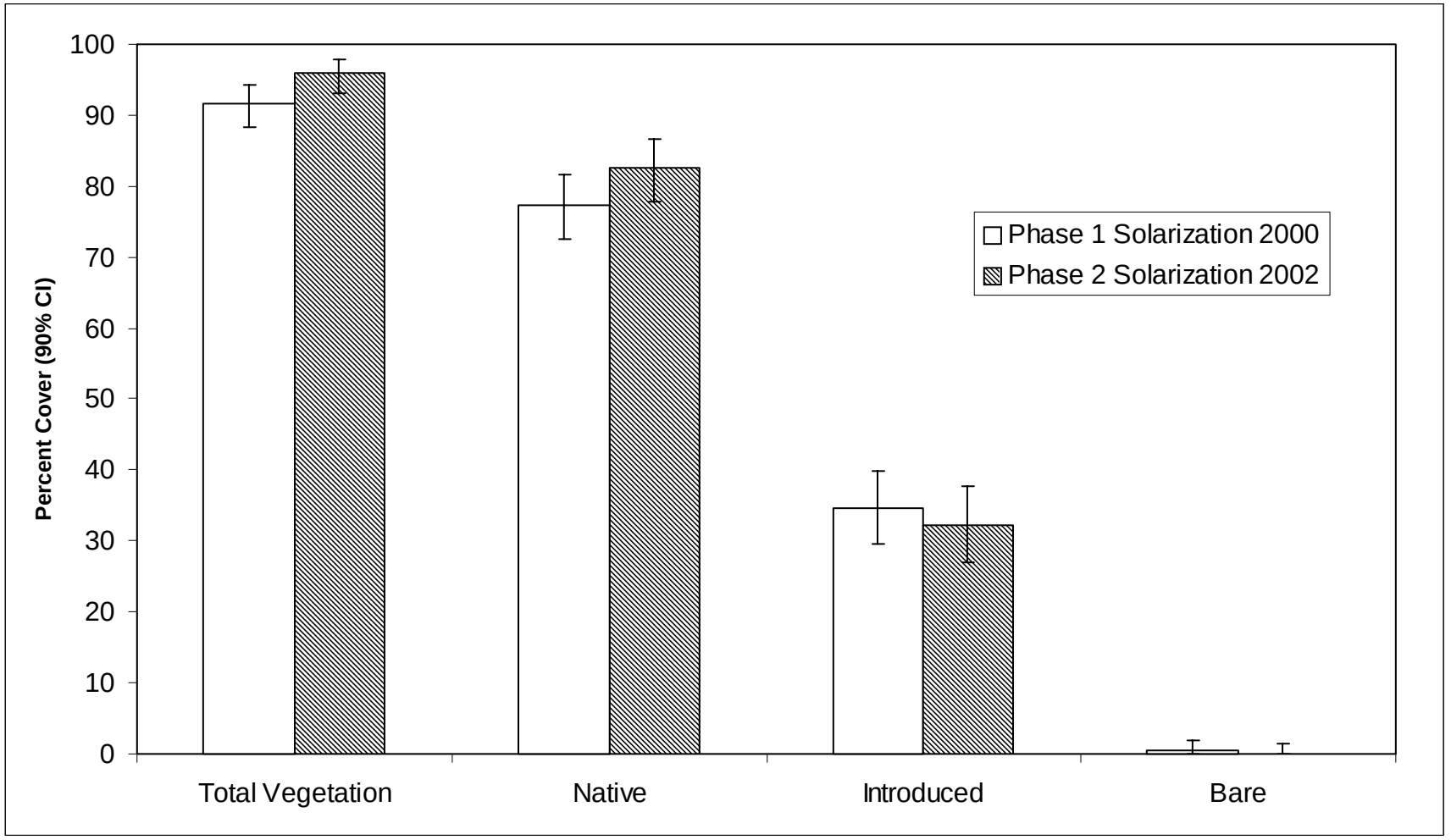


Figure 12.5. Percent cover of ground cover guilds in the North Greenhill Phase 1 and 2 solarizations. The total percent cover of all vegetation, native species, introduced species, and bare ground are graphed for both North Greenhill solarization trials. Data were collected for each trial the second year after planting.

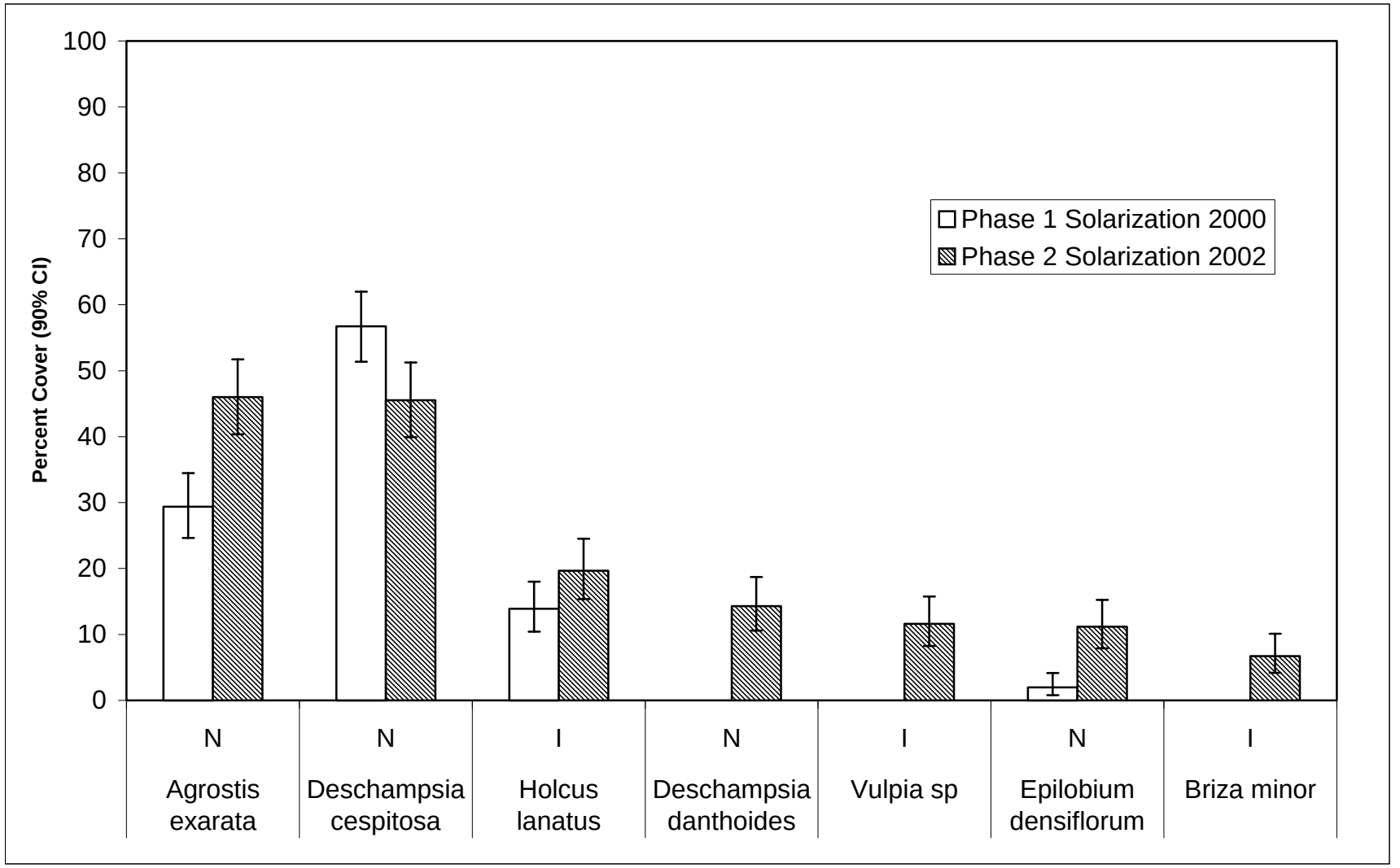


Figure 12.6. Species in the North Greenhill Phase 1 and 2 solarizations with > 5% cover. All species in 2002 with greater than five percent cover are graphed for both North Greenhill solarization trials. Data were collected for each trial the second year after planting.

Phase 2 Sod-Removal Seed Assessment Results:

The second seeding of Phase 2 achieved moderate success. Of the 24 emergent species seeded, 25% were observed and 3 of those seen were ranked as either 'common' or 'dominant.' This low percentage of success with emergent species may not be of concern, considering that there is very little to no emergent habitat in this phase. Twelve vernal pool species—slightly over 63%—were observed. Five of those species ranked as 'dominant' or 'common.' Of the wet prairie species seeded, 41% of the 44 species were observed. The abundance of 6 of the species observed were ranked as 'dominant' or 'common.' The relatively low success rate for the wet prairie species may be due in part to the normally low success rate with *Carex* sp., *Juncus* sp., and plants in the Lily family. These account for 15 of the species not observed. Research is currently under way to help discover why these species are so difficult to establish in restored areas.

Table 12.3. North Greenhill Phase 2 seed assessment. Three seed mixes were spread on North Greenhill Phase 2, an emergent mix, a vernal pool mix, and a wet prairie mix. The table includes the species seeded, their common name and wetland indicator status, their prominence within the hydrologic regime, and the weight of seed applied for each species. Each species seeded was ranked as either 'D' (dominant), 'C' (common), 'U' (uncommon), or 'T' (trace).

Species	Common name	Wetland Indicator	Emergent (0.25 acres)		Vernal Pool (2 acres)		Wet Prairie (5.8 acres)	
			grams	Status	grams	Status	grams	Status
Agrostis exarata	spike bentgrass	FACW				U	667	D
Alisma plantago-aquatica	waterplantain	OBL	30					
Beckmannia syzigachne	American sloughgrass	OBL	300	U	1600			
Camassia quamash	common camas	FACW*					368	
Carex densa	dense sedge	OBL	20				358	
Carex feta	green-sheath sedge	FACW					232	
Carex obnupta	slough sedge	OBL	50					
Carex unilateralis	one-sided sedge	FACW					590	
Danthonia californica	California oatgrass	FACU*					280	
Deschampsia cespitosa	tufted hairgrass	FACW			100	U	2141	D
Downingia sp.	downingia	OBL	35	D	300	D	895	C
Eleocharis ovata	ovoid spike-rush	OBL	50					
Eleocharis palustris	common spikerush	OBL	50					
Epilobium densiflorum	dense spike-primrose	FACW-	15		80	C	580	C
Eriophyllum lanatum	wooly sunflower	NOL*					290	U
Eryngium petiolatum	coyote thistle	OBL	12.5		100			
Gnaphalium palustre	lowland cudweed	FAC+	12.55	C	70	C		
Gratiola ebracteata	bractless hedge-hyssop	OBL		C	200	D		
Grindelia integrifolia	Willamette V. gumweed	FACW					100	
Haplopappus racemosus	racemed goldenweed	FAC*					75	
Hordeum brachyantherum	meadow barley	FACW-*	50		800		870	T
Juncus acuminatus	slender rush	FACQ-	20		100		406	
Juncus bolanderi	Bolander's rush	OBL	10	U	80			
Juncus ensifolius	swordleaf rush	FACW					140	
Juncus oxymeris	pointed rush	FACW+	12.5					
Juncus patens	spreading rush	FACW	12.5					
Juncus tenuis	slender rush	FACW-					271	
Lasthenia glaberrima	smooth lasthenia	OBL	10	U	80	U		
Lomatium nudicaule	barestem desert-parsley	NOL*					185.5	

Table 12.3. North Greenhill Phase 2 seed assessment. Three seed mixes were spread on North Greenhill Phase 2, an emergent mix, a vernal pool mix, and a wet prairie mix. The table includes the species seeded, their common name and wetland indicator status, their prominence within the hydrologic regime, and the weight of seed applied for each species. Each species seeded was ranked as either 'D' (dominant), 'C' (common), 'U' (uncommon), or 'T' (trace).

			Emergent (0.25 acres)		**Vernal Pool (2 acres)**		**Wet Prairie (5.8 acres)**	
Lomatium nudicaule	barestem desert-parsley	NOL*					10	
Lotus formosissimus	seaside lotus	FACW+					39	
Lotus purshianus	Spanish-clover	NOL*					87	
Ludwigia palustris	water purslane	OBL	10					
Madia glomerata	cluster tarweed	FACU+			40			
Madia sativa	coast tarweed	NOL*					114.5	C
Microseris laciniata	cut-leaved microseris	NOL*					580	U
Microsteris gracilis	pink microsteris	FACU			10	U	27	U
Montia linearis	narrow-leaved montia	NOL*					104.5	U
Navarretia intertexta	needle-leaved navarrertia	FACW		C	60	U		
Orthocarpus bracteosus	rosy owl-clover	NOL*					53	U
Orthocarpus hispidus	hairy owl-clover	FACU-					63	
Panicum occidentale	western witchgrass	FACW					159	U
Perideridia gairdneri	yampah or false-carraway	FAC*					16	
Plagiobothrys figuratus	fragrant popcorn-flower	FACW		C	120	D	348	D
Polygonum hydropiperoides	marshpepper smartweed	OBL	20					
Potentilla gracilis	slender cinquefoil	FAC					406	
Prunella vulgaris	self-heal	FACU+					291	U
Ranunculus alismafolius	water-plantain buttercup	FACW	10					
Ranunculus occidentalis	western buttercup	FAC					530	U
Ranunculus orthorhynchus	straight beaked buttercup	FACW-					630	T
Rorripa curvisiliqua	western yellowcress	OBL	12.5		90	T		
Rumex salicifolius	willow dock	FACW	10		60		174	
Saxifraga oregana	bog saxifrage	FACW+					35	
Scirpus validus	tule, softstem bulrush	OBL	30					
Sisyrinchium idahoense	Idaho blue-eyed grass	FACW					58.5	
Sparganium emersum	simplestem bur-reed	OBL	20					
Veronica peregrina	purslane speedwell	OBL			100	U		
Veronica scutellata	marsh speedwell	OBL	30				725	
Wyethia angustifolia	narrow-leaf mule's ears	FACU					580	
Zigadenous venenosus	death camas	FACU*					13	

3. Wildlife Utilization

Wildlife sightings for 2003 were similar to those of previous years. Mallard, Canadian goose, northern harrier, common snipe, and northern flicker were all bird species commonly observed on the site. Evidence of raccoons and deer were again found in the unit.

Chapter 13: Stewart Pond, Grimes Pond, and Teal Slough Unit

A. Site Description

1. Size: 30 acres

2. Ownership: BLM

3. Site Timeline: **Table 13.1**

Section	Year of Construction	Acreage	Monitoring Period
Stewart Pond Extension	1995	1.8	1996-2002, extended to 2003
Ash woodland Expansion	1995	0.25	1996-2002, extended to 2003

4. Location

The Stewart Pond, Grimes Pond, Teal Slough Unit of the Stewart Management Area is located along the western slope of Stewart Knoll, north of Stewart Road and south of the A3 Channel in west Eugene, Or.

5. Site History

This site has a variety of past land uses. The area of Stewart Pond was once used as part of a dairy farm. The water features in the north, Grimes Pond and Teal Slough, were created when gravel was excavated.

6. Focus of Prescriptions

In general, prescriptions applied to Stewart Pond, Grimes Pond and Teal Slough sought to integrate existing wetland areas located across the breath of the site. This objective was met through restoration, enhancement, and creation of emergent wetland. Measures to enhance wildlife habitat included placing logs in the ponds and planting dead trees along the fringe of the upland and wetland boundary to offer snags for birds to perch and nest in. Prescriptions were completed in 1995.

7. Site-Specific Management Goals

1. Expand the existing emergent wetland.
2. Eliminate or reduce concentrations of reed canarygrass at the site.
3. Increase the extent and suitability of habitat available for migratory birds and other wetland wildlife species.
4. Promote wildlife viewing and environmental education opportunities.
5. Expand the existing riparian woodland along the fringes of Teal Slough.

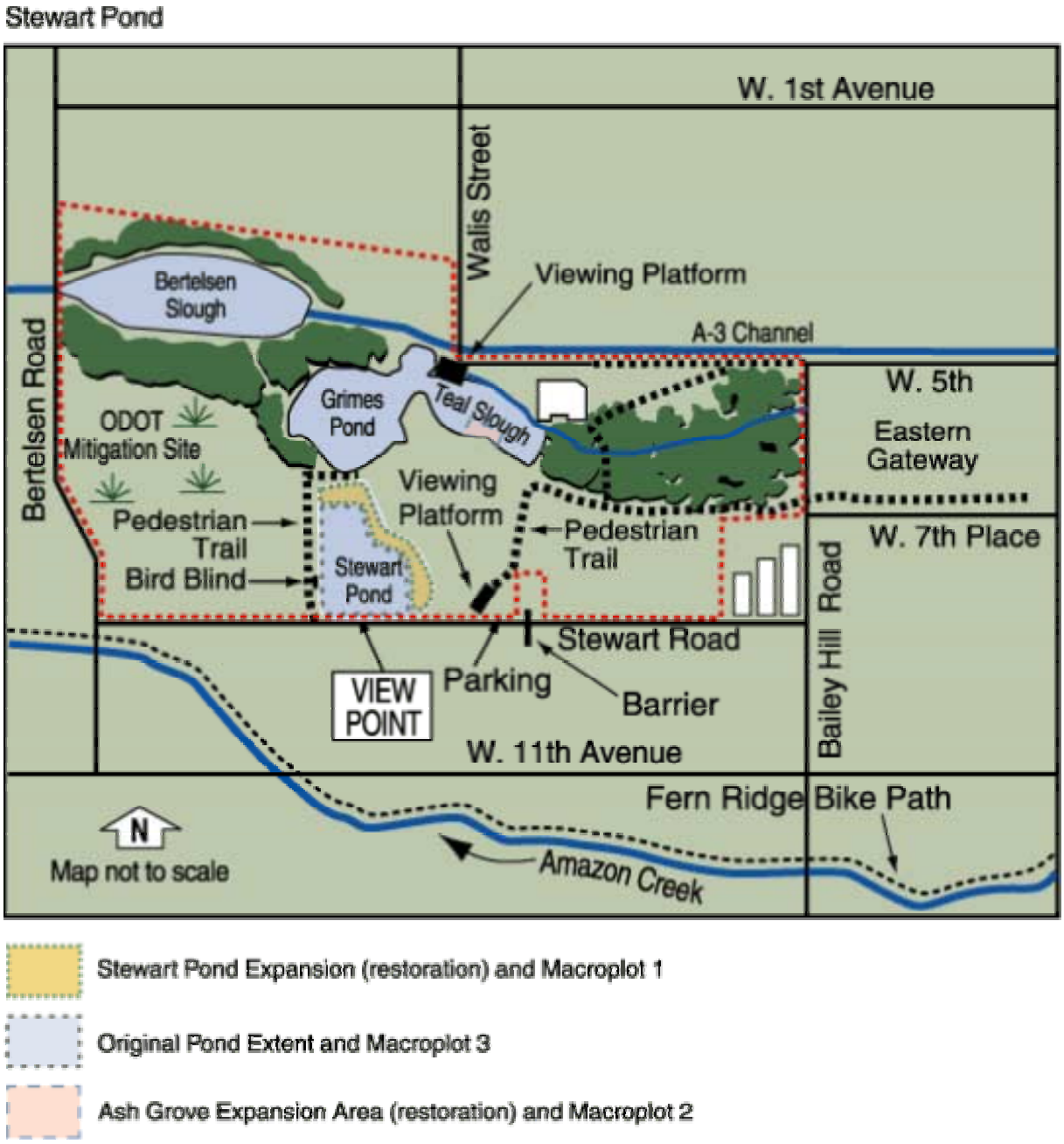


Figure 13.1. Stewart Pond, Grimes Pond, and Teal Slough Site Map. The original pond, the pond expansion, and the slough expansion areas are labeled with their associated macroplots.

B. 2002 Monitoring Summary

The entire area continues to show hydrology sufficient to support the development of hydric soils and hydrophytic vegetation. Both the pond expansion and the swale extension met native species cover goals. The pond expansion also met species richness requirements through the seed survival standard. Even though the ash swale expansion did not meet the seeding goal, the species composition observed demonstrates that the area is dominated by native hydrophytic vegetation. The monitoring period was extended one year so that nested frequency data could be collected next summer to determine the site's success in meeting the frequency performance standards.

Invasive vegetation presents the biggest challenge for the site. Reed canarygrass is the most serious invader and continued efforts to remove this species will be crucial to the site's long-term success.

1. 2002 Management Actions

Original Pond:

1. The interior was mowed to prevent the seed set of the reed canarygrass.
2. Volunteers spent one day removing Armenian blackberry and reed canarygrass.
3. Small areas in the northern section of the pond were disked to develop shorebird habitat and to control the spread of reed canarygrass.

Pond Expansion:

1. A maintenance crew spent two days clipping the heads off teasel and thistle plants.
2. A patch of reed canarygrass was solarized.

The southern banks of Grimes Pond:

A large root was and tree stump from Hendricks Park were deposited at the southern edge of Grimes Pond to provide additional habitat structure.

2. Management Actions for 2003

Original Pond:

1. Continue to mow as soon as it is dry enough to prevent the reed canarygrass from going to seed in the spring.
2. Till the area in the fall to provide habitat for shorebirds.

Pond Expansion:

1. Sow a seed mix comprised of aggressive vernal pool species. The seed mix should include: *Downingia yina, Downingia elegans, Plagiobothrys figuratus, Epilobium densiflorum, Deschampsia cespitosa, Beckmannia syzigachne, Agrostis exarata, Navarretia intertexta,* and *Eryngium petiolatum*.
2. Localized weed control. Use a variety of techniques (e.g., solarization, hand pulling, and torching) to remove non-native plants such as reed canarygrass and pennyroyal. This effort should focus on eliminating only the patches of non-natives, and minimizing impacts to native species

The southern banks of Grimes Pond:

1. During winter 2003, harvest stakes from the existing willows that are growing around the pond and planted them around the south and eastern edge of the pond.
2. Have staff or volunteers put stakes in the ground.

Cottonwood swale east of Teal Slough:

1. Under the cottonwoods, sow a seed mix of the following species: *Carex obnupta, Carex stipata, Carex lanuginosa, Beckmannia syzigachne, Geum macrophyllum, Ranunculus uncinatus,* and *Thalictrum polycarpum.*
2. Localized weed control. Use a variety of techniques (e.g., solarization, hand pulling, and torching) to remove non-native plants such as reed canarygrass and pennyroyal. This effort should focus on eliminating only the patches of non-natives, and try to minimize impacts to the many natives that are doing well.

Table 13.2. Progress of the Stewart Pond Complex of restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Vegetation Standard in MOA	Stewart Pond Expansion	Goal Met?	Woodland Expansion	Goal Met?
Site status in the monitoring period	1996-2002, extended to 2003	N/A	1996-2002, extended to 2003	N/A
Most recent quantitative data collected in:	PI - 2002	N/A	PI - 2002	N/A
70% native **cover** after 5 years	75%	Yes	80%	Yes
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2003	TBD	2003	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	82%	Yes	41% (see monitoring discussion)	No
Wet Prairie: minimum of 10 native species occurring at 10% **frequency** rate or greater	2003	TBD	2003	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2003	TBD	2003	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during 2 site visits, the first in early spring and the second in late fall. Water depths were measured periodically at 1 staff gauge.

b) Results

Stewart Pond and its associated restorations continue to exhibit hydrology sufficient for the development of hydric soils and hydrophytic vegetation. The percent area with saturated soils returned to normal levels after two years of much lower than average rainfall. There was a large jump in standing water this spring (March), the reason for which is unknown. We did, however, receive 4.28 inches of rain in March, of which 3.52 inches occurred between March 5th and the 13th.

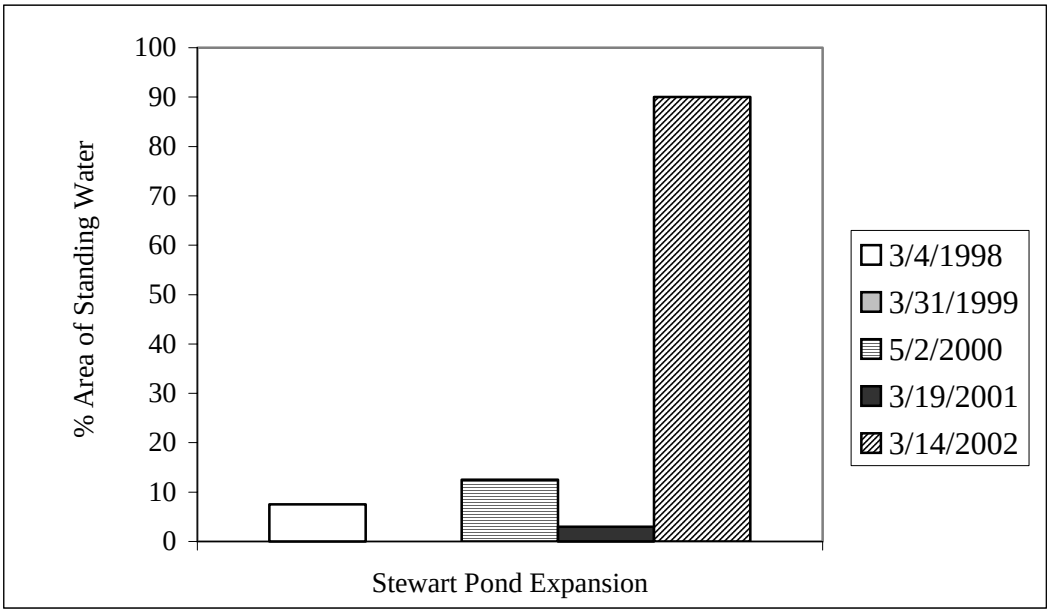


Figure 13.2. Spring standing water in the expansion of Stewart Pond. Percentage of the pond expansion with standing water in the early spring over the history of the restoration.

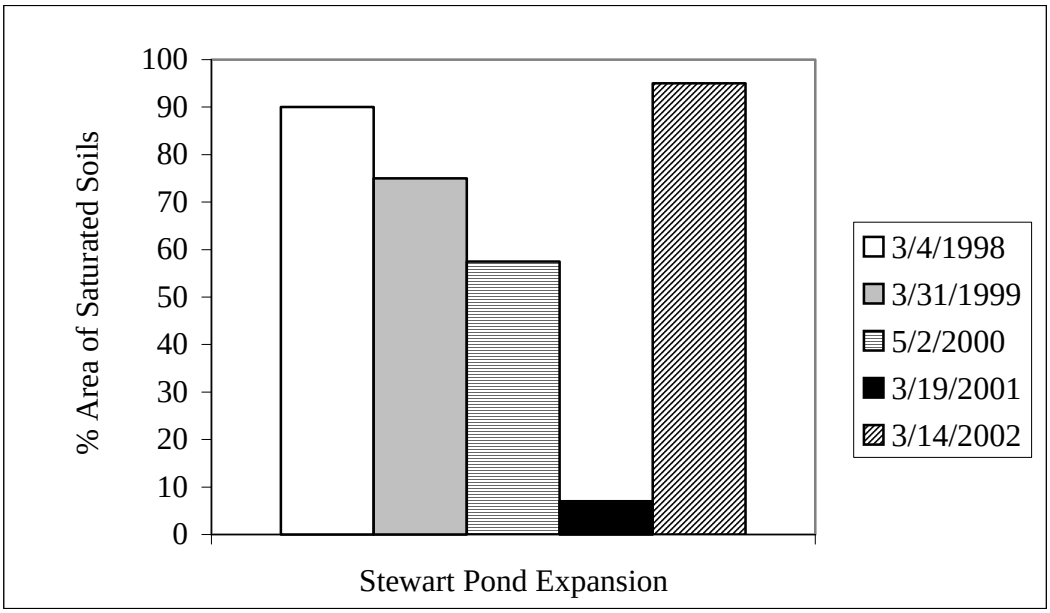


Figure 13.3. Spring saturated soils in expansion of Stewart Pond. Percentage of the Stewart Pond expansion with saturated soils in the early spring over the history of the restoration.

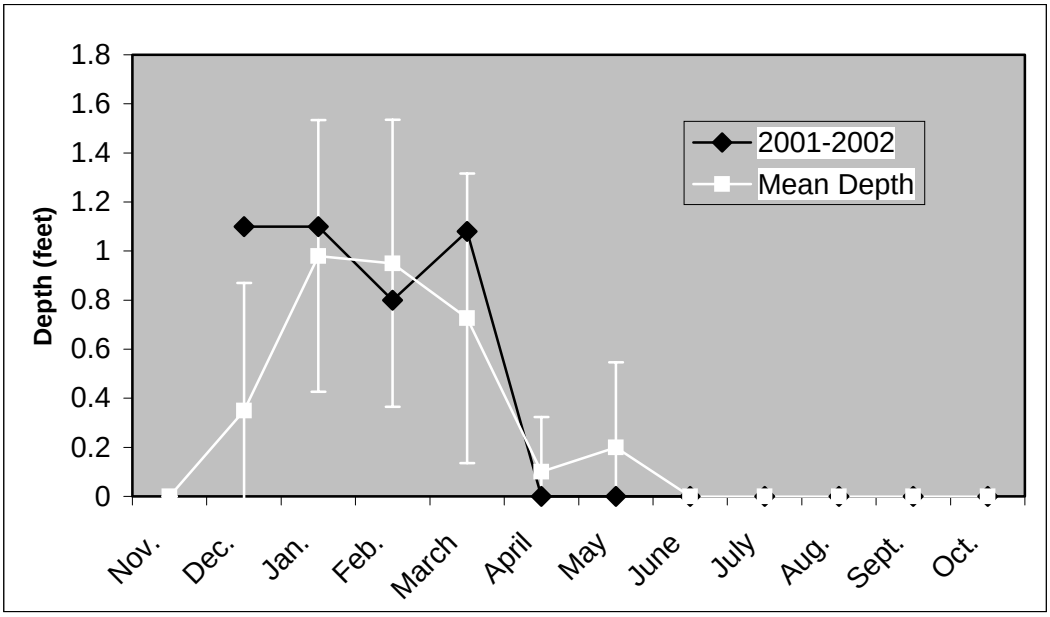


Figure 13.4. Inundation levels in the pond expansion during 2001-2002 compared to the mean and standard deviation of depths between 1998 and 2002. Depth of inundation throughout the year in the pond expansion area over 2001-2002. The mean and standard deviation calculated from depths observed between 1998 and 2002 are also graphed for comparison.

2. Vegetation

a) Methods

Point-intercept data were collected for the pond extension and the ash swale extension. A total of 238 point were collected in the pond extension, while only 39 were collected in the ash swale extension because the are is quite small (¼ of an acre). The general species list for the site was also updated and can be viewed in Appendix B.

b) Results

Both the Stewart Pond expansion and the ash swale expansion restorations met the 5th year performance standard of 70% cover of native vegetation. The relative percent cover of the native species in the pond expansion is 75%, while the relative percent cover of natives in the ash swale expansion is 80%. There is still a large proportion of introduced species cover in both areas (50% in the pond expansion and 35% in the swale expansion). *Agrostis alba/tenuis* and *Mentha pulegium* contribute heavily to the total cover of exotic species in both macroplots, but in contrast to other restorations, hand weeding appears to keep them from dominating the site.

Another vegetative performance standard states that at least 70% of the native species planted are to be present the final year of monitoring. The pond expansion exceeds this standard with 82% of the species planted being present. Only 41% of the species planted in the ash swale expansion were present this summer; however, many of the species planted were not appropriate for the hydrology of the area. Also, 33 native species were planted, and while 28 native species were present in the macroplot, the majority of these species colonized the site naturally.

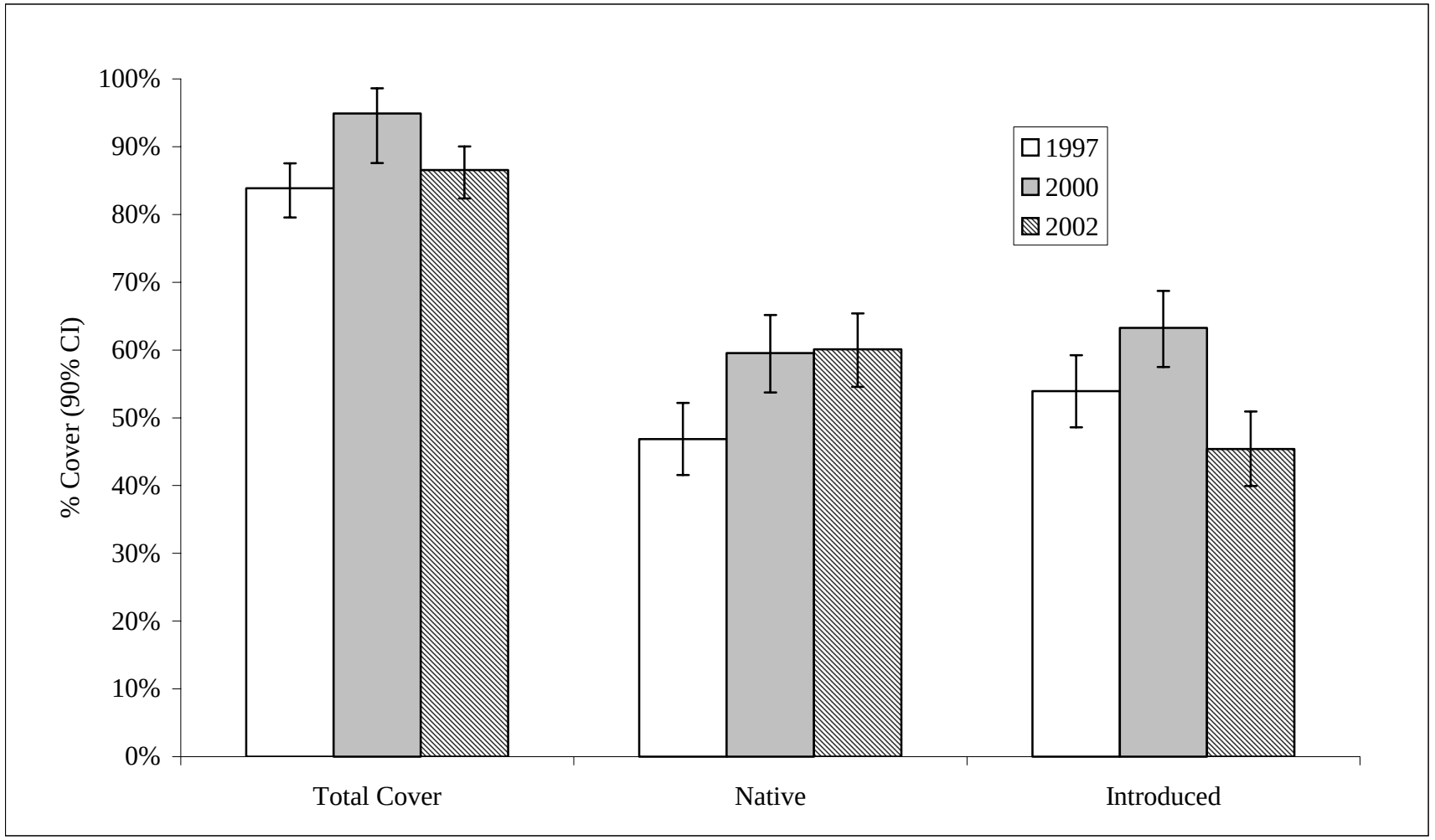


Figure 13.5. Percent cover of ground cover guilds in the Stewart Pond Extension. The total percent cover of all vegetation, native species, and introduced species in the Stewart Pond Extension.

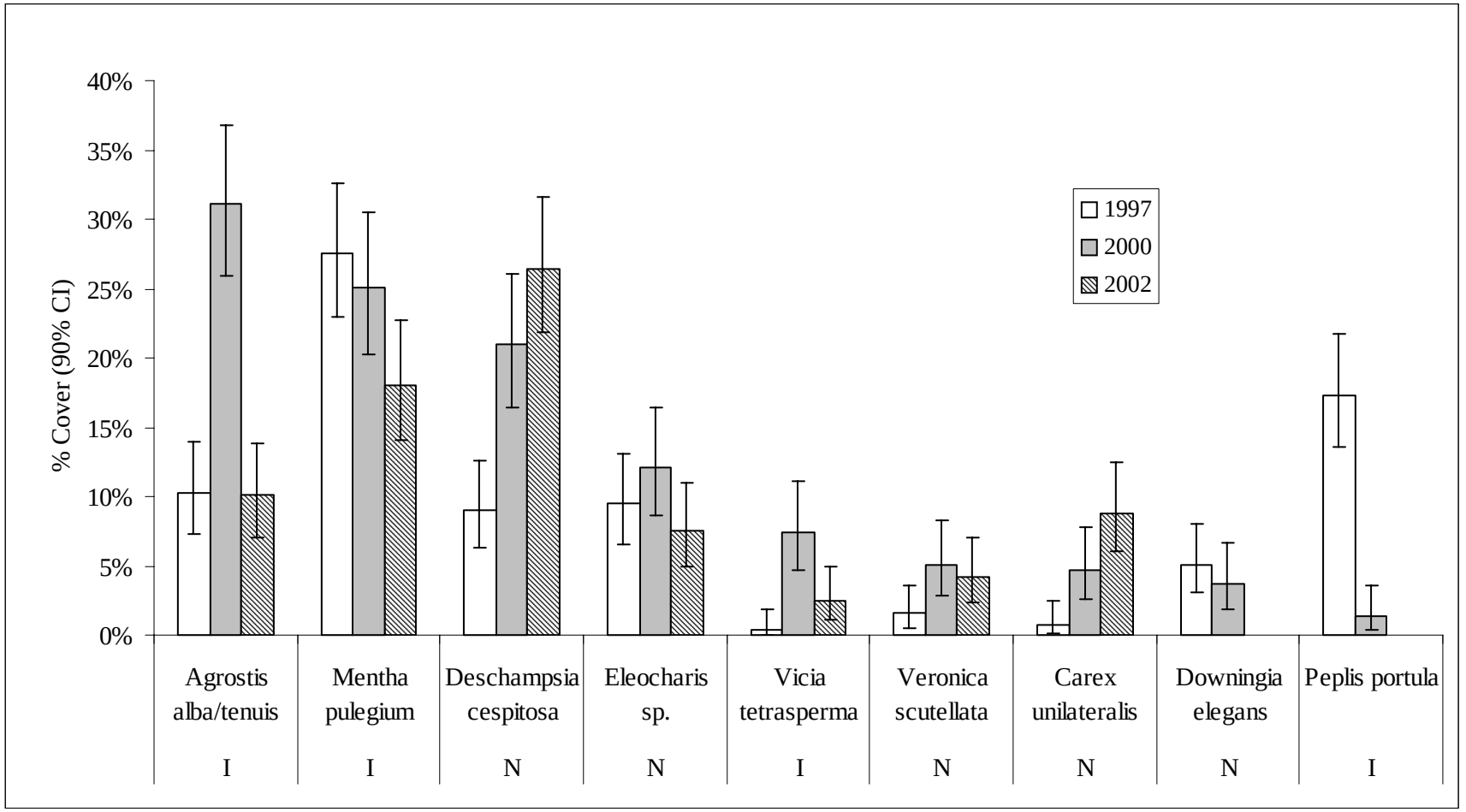


Figure 13.6. Species in the Stewart Pond Extension with > 1% cover. All species in 2002 with greater than one percent cover are graphed for the pond extension. Each species is also labeled with either and 'N' or an 'I' to indicate whether it is a native or introduced species.

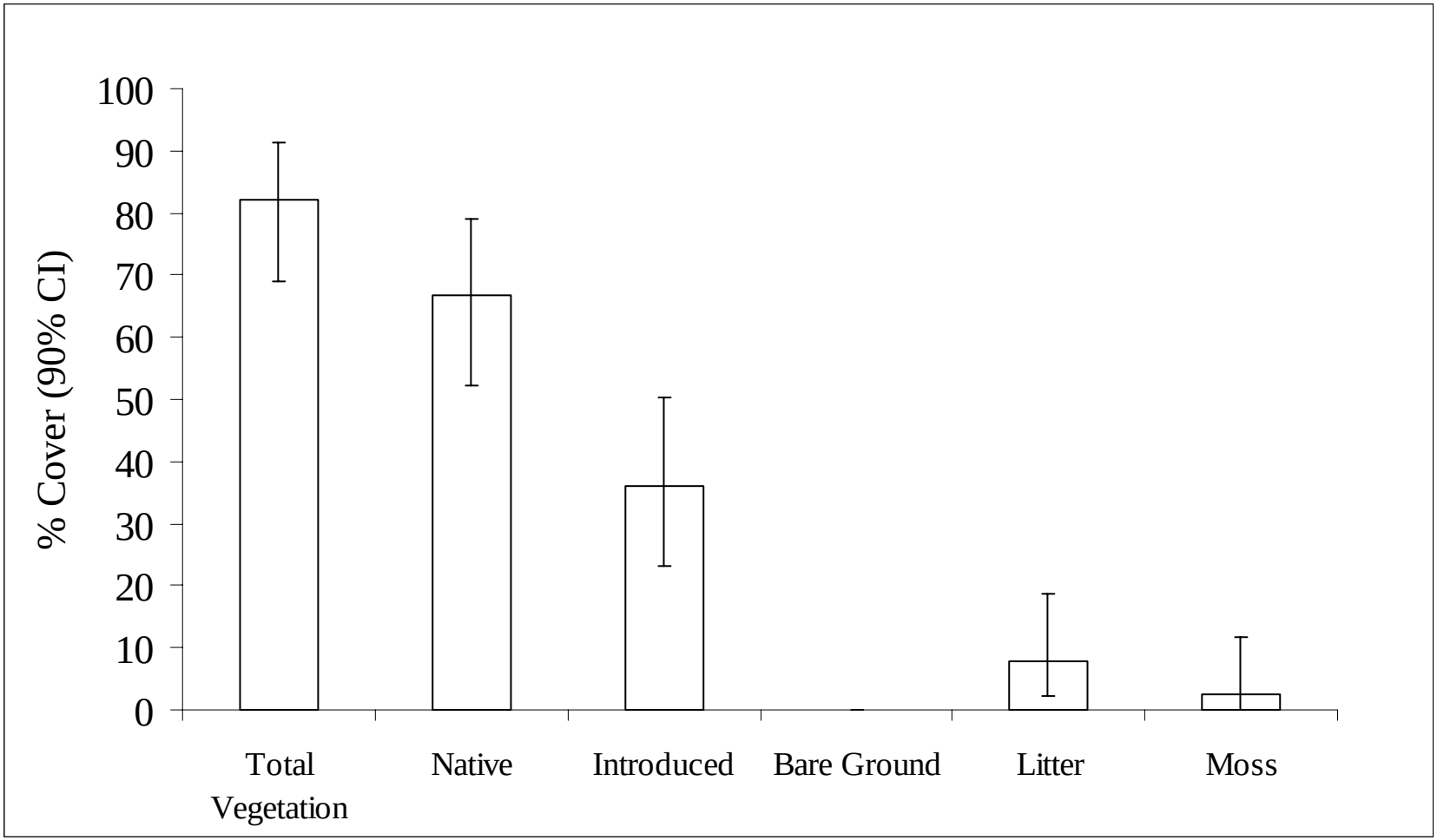


Figure 13.7. Percent cover of ground cover guilds in the Stewart Pond ash swale extension. The total percent cover of all vegetation, native species, introduced species, bare ground, litter, and moss are reported for the Stewart Pond ash swale extension.

3. Wildlife Utilization

The Stewart and Grimes ponds/ Teal Slough complex of wetlands continues to be the most utilized by wildlife of all the mitigation bank sites. While waterfowl are most common, hawks, coots, shorebirds, gulls and swallows, bufflehead, turkey vultures, ring-necked pheasants, greater yellowlegs, common snipe, belted kingfishers, violet-green swallows, scrub jays, American crows, and red-winged blackbirds have all been seen at the site. However, with the proliferation of reed canarygrass in the area of the main pond, the site has become less valuable for shorebirds. Actions are currently being taken to regain the site's utility for these species. (For a more complete list of species that use the site see the 1998 Annual Report.)

Chapter 14: Turtle Swale Unit

A. Site Description

1. Size: 60.5 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 14.1**

Section	Construction Year	Acreage	Monitoring Period
Phase 1	2001	10.07	2002-2006
Phase 2	2002	11.62	2003-2007
Phase 3	2003	To be determined	2004-2008

4. Location

Turtle Swale is Unit 1 of the 398 acres of the Lower Amazon Wetland Restoration and Enhancement Project. It occupies the area south of Royal Avenue between the Amazon Diversion Channel and the Amazon Creek in west Eugene, OR.

5. Site History

There have been a variety of past land uses on this site. The eastern tax lot was cultivated for ryegrass. The western tax lot below Turtle Swale appears to have been heavily cultivated. Portions of the site north of the swale were filled with a variety of urban debris and approximately 32,000 cubic yards of fill material. The remainder of this section may have been grazed, but appears not to have been tilled.

6. Focus of Prescriptions

The overall goal for the Turtle Swale Unit is to protect and enhance higher quality areas and their associated populations of rare species, while restoring the highly degraded areas that were historically wet prairie and emergent communities. This will be done by removing existing fill piles, the adjacent channel levees, colonies of reed canarygrass, and restoring the historic swale that runs east to west across the site.

7. Site-Specific Management Goals

1. Restore the emergent areas by eliminating or reducing concentrations of reed canarygrass.
2. Restore the historic swale running east to west across the site for western pond turtle habitat.
3. Protect and enhance the populations of rare plant species on the site. These species include *Aster curtus*, *Lupinus sulphureus* var. *kincaidii*, and *Asclepias fasicularis*.

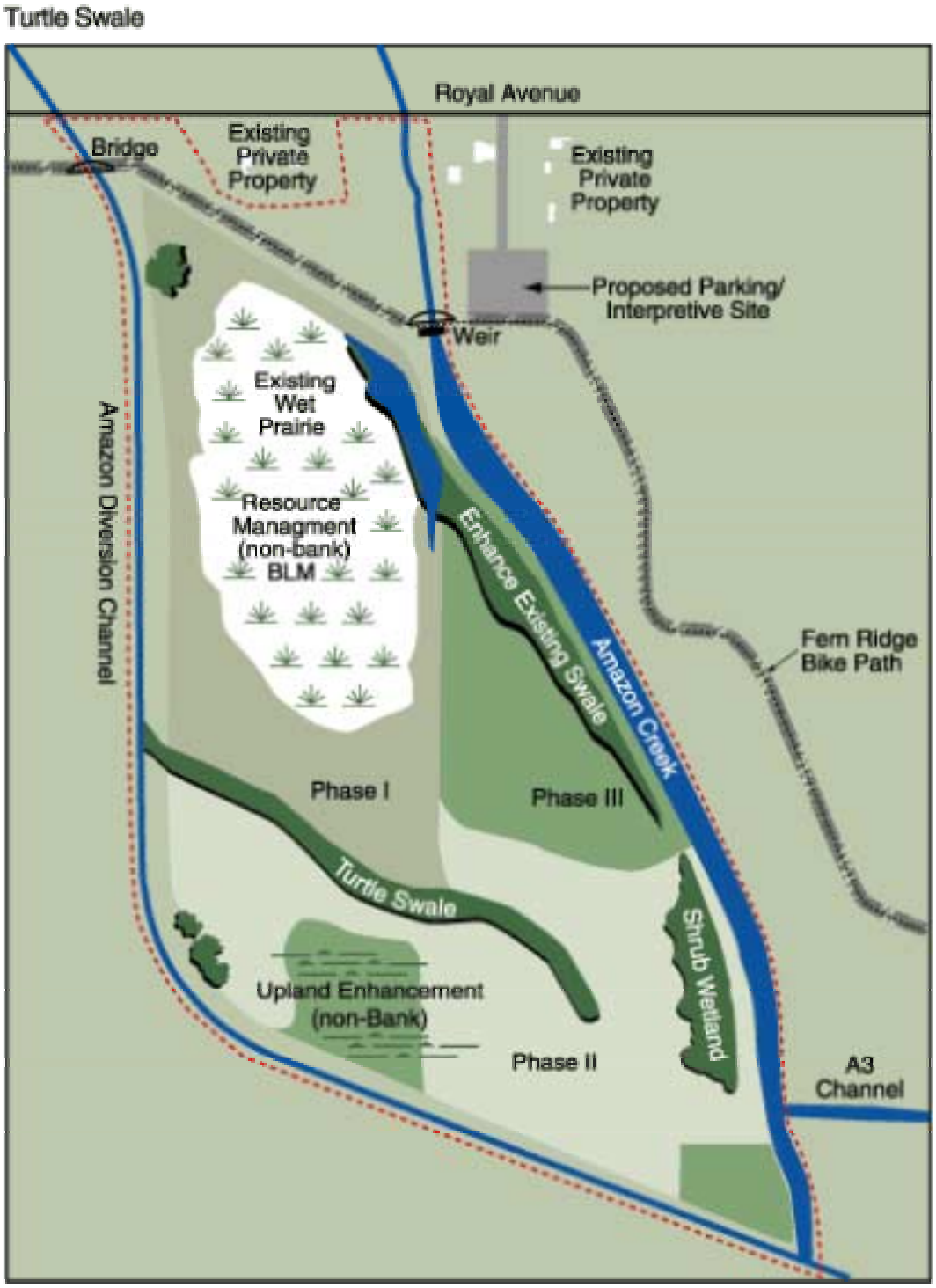


Figure 14.1. Turtle Swale Site Map. The Phases, enhancement areas and pre-existing wet prairie areas are labeled. Community vegetation monitoring will begin in 2003. Macroplots created for this purpose will be added to the map next year.

B. 2002 Monitoring Summary

Turtle Swale Phase 1 appears to be progressing towards meeting mitigation bank standards. The site preparation appeared to remove the majority of the seed bank and rhizomes that were present in the sod before its removal. However, species such as reed canarygrass, Harding grass, and pennyroyal will need to be continually removed to prevent dense recolonization. The seeding of Phase 1 resulted the appearance of 42 native species. Dominant species of the wet prairie, such as *Deschampsia cespitosa* and *Agrostis exarata*, appear to be establishing well. Many plugs planted in the fall of 2001 did not establish. Possible explanations for their disappearance include herbivory and wash-out during high water events. There is some evidence to support both of these theories.

1. 2002 Management Actions

Phase 1:

Maintenance crews spent 18 days removing exotics from the restoration area. The main target species included reed canarygrass, thistles, teasel, St. John's wort, pennyroyal, and non-native bentgrasses.

Phase 2:

Phase 2 was constructed this fall. The focus of Phase 2 was to enhance the existing wetland on the south bank of Turtle Swale and around a naturally occurring upland area being managed for a Kincaid's lupine population. Removing the reed canarygrass sod layer and seeding with a mix of native wet prairie species enhanced a total of 12.54 acres of wetlands. Implemented during the summer of 2002 using BLM road maintenance crews, a 0.75 acre area of fill was also removed from the west bank of the "A" Channel near the mouth of the A-3 Channel. Using historical air photos, the Turtle Swale channel was excavated further eastward. The swale was located in the eastern tax lot by following the gravel and pieces of concrete foundation that were buried there in the old channel bed.

Remnant Prairies:

1. Removed teasel and thistles from the northern remnant.
2. Cut teasel heads from around the milkweed population in the southeast corner of the site.
3. Removed scattered reed canarygrass.

2. Management Actions for 2003

Phase 1:

1. Hand weed under ash/ hawthorns at the northwest corner.
2. Remove a population of *Holcus lanatus* that is just south of the remnant prairie and north of swale. Mow or weed wack to prevent flowering of this population in the spring, then remove sod in summer.
3. Maintain turtle basking mounds by preventing the establishment of dense vegetation.
4. Add large wood to swale.
5. Remove western haul road, grade, and re-seed.
6. General site-wide hand weeding.
7. Install 1- 5 ¾ " board to head gate in the swale to prevent backflow from Amazon Channel.

Phase 2:

1. General site-wide hand weeding.

Phase 3:

1. Mow Phase 3 to prevent introduced species from going to seed.

Remnant Prairies:

1. Manage thistle and teasel populations in remnant prairies.
2. Control introduced blackberry on restoration and enhancement site edges.
3. Solarize reed canarygrass and Harding grass populations.

Table 14.2. Progress of the Turtle Swale Unit restorations towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard.

Vegetation Standard in MOA	Phase 1	Goal Met?	Phase 2	Goal Met?
Site status in the monitoring period	2002-2006	N/A	2003-2007	N/A
70% native **cover** after 5 years	2003	TBD	2004	TBD
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2006	TBD	2007	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	2006	TBD	2007	TBD
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2006	TBD	2007	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2006	TBD	2007	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped for Phase 1 during 2 site visits, the first in early spring and the second in late fall. Staff gauges were installed in three locations and monitoring of these gauges will begin in 2003. Hydrology monitoring for Phase 2 will begin in 2003 as well.

b) Results

Phase 1 held significant amounts of water this winter and spring, particularly the emergent areas in the extreme northeast and northwest, as well as, in the restored swale that runs east to west across the southern portion of the site. Additionally, many vernal pools persisted into the spring growing season. On May 23 of 2002, 15% of Phase 1 had standing water and 20% of the site had saturated soils to the ground surface. This indicates that the site has sufficient hydrology to promote the development of hydric soils and hydrophytic vegetation. Soil pits will be dug on Phase 1 this spring to confirm this determination.

2. Vegetation

a) Methods

A seeding assessment for Phase I was completed during two site visits: June 12, 2002 and September 11, 2002. It was necessary to do the second seed assessment this late in the year because the emergent areas

did not dry out until late in the summer. Each species seeded that was also observed during the site visits was given a value of 'Dominant,' 'Common,' 'Uncommon,' or 'Trace.' A general plant species list for the site was also updated and can be viewed in Appendix B.

b) Results

The seeding of Phase 1 was moderately successful. Four seed mixes were spread on the site, an emergent, wet prairie, wet prairie buffer, and a vernal pool mix. For the emergent mix, 50% of the species seeded were observed and 3 of the 41 species seeded received a rating of 'dominant' or 'common.' Of the species seeded in the wet prairie mix, 44% were observed and 8 out of 43 received a 'common' or higher rating. Thirty-five percent of the species seeded in the wet prairie buffer mix were observed, and 7 of the 51 species seeded were listed as 'dominant' or 'common.' The vernal pool mix achieved the greatest success with 80% of the species seeded were observed and 7 of the 20 species were considered to be present at levels of 'common' and above. The reasons for the widely varied success rates are unknown. The large volume of sheet water on the site during the winter after planting may have washed some seed away. Seed germination and subsequent survival may also have been hindered by the relatively dry spring (see Appendix C for rainfall data).

Table 14.3. Emergent areas seed assessment. A total of 2.75 acres were seeded with an emergent plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted.

Species	Status	% seed	seed wt. g/ acre
Alisma plantago-aquatica	Trace/Uncommon	6.4	450
Beckmannia syzigachne		33.9	2400
Carex densa		1.4	100
Carex densa		1.1	80
Carex lanuginosa		0.2	14
Carex obnupta	Trace	3.9	275
Carex stipata		0.3	22
Carex tumulicola		0.6	45
Carex tumulicola		0.6	41
Deschampsia cespitosa		2.8	200
Downingia spp.	Dominant	2.8	201.25
Eleocharis acicularis		0.1	3.9
Eleocharis ovata	Uncommon	3.9	275
Eleocharis palustris	Trace	3.9	275
Epilobium densiflorum	Uncommon	1.6	110
Eryngium petiolatum	Trace/Uncommon	1.2	87.5
Glyceria occidentalis		2.5	177
Gnaphalium palustre	Uncommon	0.9	61
Grindelia intergrifolia	Trace	0	0
Hordeum brachyantherum	Trace	9.2	650
Juncus acuminatus	Trace	1.2	87.5
Juncus bolanderi	Trace	1.0	70
Juncus effusus		N/A	plugs
Juncus oxymeris		2.3	162.5
Juncus patens		2.3	162.5
Juncus patens	Common	N/A	plugs
Lasthenia glaberrima		1.0	70

Table 14.3. Emergent areas seed assessment. A total of 2.75 acres were seeded with an emergent plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted.

Species	Status	% seed	seed wt. g/ acre
Lotus purshianus	Common	0	0
Ludwigia palustris	Uncommon	0.6	43.7
Myosotis laxa	Trace	0.2	17
Navarretia squarosa	Trace	0	0
Polygonum hydropiperoides	Trace	2.8	195
Ranunculus alismafolius		0.7	52.5
Rorripa curvisiliqua		1.6	112.5
Rumex salicifolius		1.0	67.5
Scirpus validus	Uncommon	3.5	250
Scirpus validus	Trace	N/A	plugs
Sparganium emersum		1.2	87.5
Veronica americana		0.1	8
Veronica peregrina	Trace	0	0
Veronica scutellata	Trace	3.1	218.75

Table 14.4. Vernal pool areas seed assessment. A total of 2.0 acres were seeded with a vernal pool plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted. Species observed in this hydrologic regime, but were not included in this seed mix, but may have been included in another are included at the bottom of the chart.

Species	Status	% seed	seed wt. g/ acre
Agrostis exarata	Common	5.2	230
Beckmannia syzigachne	Trace	36.4	1600
Deschampsia cespitosa	Common	9.1	400
Downingia spp.	Dominant	4.6	200
Epilobium densiflorum	Common	1.8	80
Eryngium petiolatum	Uncommon	2.3	100
Gnaphalium palustre	Common	1.6	70
Gratiola ebracteata	Common	4.6	200
Hordeum brachyantherum	Uncommon	18.2	800
Juncus acuminatus		2.3	100
Juncus bolanderi		1.8	80
Lasthenia glaberrima	Uncommon	1.8	80
Madia glomerata		0.9	40
Microsteris gracilis	Uncommon	0.2	10
Navarretia intertexta	Uncommon	1.4	60
Plagiobothrys figuratus	Dominant	2.7	120
Rorripa curvisiliqua	Uncommon	2.1	90
Rumex salicifolius		1.4	60
Veronica peregrina		1	43
Veronica peregrina	Uncommon	0.6	27
Glyceria occidentalis	Trace		
Panicum occidentale	Trace		
Prunella vulgaris	Trace		

Table 14.4. Vernal pool areas seed assessment. A total of 2.0 acres were seeded with a vernal pool plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted. Species observed in this hydrologic regime, but were not included in this seed mix, but may have been included in another are included at the bottom of the chart.

Species	Status	% seed	seed wt. g/ acre
Sisyrinchium idahoense	Trace		

Table 14.5. Wet Prairie areas seed assessment. A total of 10.5 acres were seeded with a wet prairie plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted.

Species	Status	% seed	seed wt. g/acre
Agrostis exarata	Dominant	5.22	1207.5
Camassia quamash		2.72	630
Carex densa		3.63	840
Carex feta		1.81	420
Carex unilateralis		4.54	1050
Danthonia californica		2.27	525
Deschampsia cespitosa	Common	9.07	2100
Deschampsia danthoides		0.15	34
Downingia spp.	Common	6.80	1575
Epilobium densiflorum	Common	4.54	1050
Eriophyllum lanatum	Uncommon	2.27	525
Galium trifidum		0.05	10.5
Grindelia intergrifolia		0.75	172.6
Haplopappus racemosus		0.61	142
Hordeum brachyantherum	Uncommon	8.21	1900
Juncus acuminatus		3.18	735
Juncus ensifolius		1.27	294
Juncus tenuis		2.04	472.5
Lomatium nudicaule		1.40	324
Lomatium nudicaule		0.19	43.5
Lotus formosissimus		0.09	20
Lotus purshianus	Common	0.68	157.5
Madia sativa	Common	0.68	157.5
Microseris laciniata	Common	4.54	1050
Microsteris gracilis	Uncommon	0.22	51.5
Microsteris gracilis		0.15	34
Montia linearis	Trace	0.86	198
Orthocarpus bracteosus	Uncommon	0.45	105
Orthocarpus hispidus	Uncommon	0.45	105
Panicum occidentale		1.36	315
Perideridia gairdneri		0.15	34
Plagiobothrys figuratus	Common	2.72	630
Potentilla gracilis		3.18	735
Prunella vulgaris	Uncommon	2.27	525
Ranunculus occidentalis	Uncommon	4.54	1050
Ranunculus orthorhynchus	Uncommon	4.54	1050

Table 14.5. Wet Prairie areas seed assessment. A total of 10.5 acres were seeded with a wet prairie plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted.

Species	Status	% seed	seed wt. g/acre
Rumex salicifolius		1.36	315
Saxifraga oregana		0.30	70
Scirpus validus	Trace	plugs	
Sisyrinchium idahoense		0.44	101.85
Veronica scutellata	Uncommon	5.67	1312.5
Wyethia angustifolia		4.54	1050
Zigadenous venenosus		0.13	30

Table 14.6. Wet prairie buffer areas seed assessment. A total of 1.3 acres were seeded with a wet prairie buffer plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted.

Species	Status Assessment	% seed	Seed wt. g/acre
Agrostis exarata	Common	2.5	97.5
Beckmannia syzigachne		6.4	250
Camassia quamash		0.8	30
Carex densa		0.8	30
Carex densa		0.4	15
Carex feta		0.4	16
Carex feta		0.3	10
Carex lanuginosa		0.1	5
Carex unilateralis		1.5	60
Carex unilateralis		0.3	10
Danthonia californica		2.6	100
Deschampsia cespitosa	Uncommon	7.0	270
Downingia spp.	Common	3.0	115
Elymus glaucus-Wolf		30.9	1200
Epilobium densiflorum	Common	2.2	85
Eriophyllum lanatum		1.7	65
Gnaphalium palustre		0.3	10
Gratiola ebracteata		0.9	35
Heracleum lanatum		3.9	150
Hordeum brachyantherum	Common	4.5	175
Juncus acuminatus	Uncommon	1.4	55
Juncus ensifolius		0.5	20
Juncus tenuis		1.0	37.5
Lasthenia glaberrima		0.4	15
Lomatium nudicaule		0.5	17.5
Lomatium nudicaule		0.3	10
Lotus purshianus		0.4	15
Lotus purshianus		0.3	12.5
Lupinus micranthus	Trace	0.5	17.5
Lupinus polyphyllus		1.6	62.5
Lupinus rivularis		0.8	32.5
Madia elegans		2.8	110

Table 14.6. Wet prairie buffer areas seed assessment. A total of 1.3 acres were seeded with a wet prairie buffer plant community seed mix. The table includes the species seeded, their prominence within the hydrologic regime, the percentage of each mix the seed occupied, and the weight of seed used per acre planted.

Species	Status Assessment	% seed	Seed wt. g/acre
Madia sativa	Common	0.6	25
Microseris laciniata	Uncommon	2.2	85
Microsteris gracilis		0.1	2.5
Montia linearis		0.2	9.5
Navarretia intertexta		0.6	23
Orthocarpus bracteosus	Uncommon	0.1	5
Orthocarpus hispidus	Uncommon	0.1	5
Panicum occidentale		0.4	15
Plagiobothrys figuratus	Common	1.3	50
Potentilla gracilis		2.2	84
Prunella vulgaris	Common	2.3	90
Ranunculus occidentalis		1.8	68.5
Ranunculus occidentalis	Uncommon	0.2	6.5
Ranunculus orthorhynchus	Uncommon	2.3	90
Rorripa curvisiliqua	Trace	0.0	0
Rumex salicifolius	Trace	1.0	40
Sisyrinchium idahoense		0.1	4.85
Veronica scutellata	Trace	2.1	80.5
Wyethia angustifolia		1.7	65

3. Wildlife Utilization

The large amount of contiguous habitat of the Lower Amazon Restoration Project, of which Turtle Swale is apart, attracts large numbers and a wide variety of wildlife. Specific sightings for Turtle Swale in 2002 include killdeer and their nests, redwing blackbirds, green heron, blue heron, mallards, red-tailed hawks, and osprey.

Chapter 15: Willow Creek Confluence Unit

A. Site Description

1. Size: 4.2 acres

2. Ownership: BLM

3. *Site Timeline:* **Table 15.1**

Section	Year of Construction	Monitoring Period
Phase 1-East	1995	1996-2004
Phase 1-West	1995	1996-2004
Phase 2	1997	1998-2004
Phase 3	1997	1998-2004

4. Location

The Willow Creek component of the BLM Wetland Field Office Management Area is located on the south side of Amazon Creek at the confluence of Willow and Amazon Creeks. The site sits on the northwestern corner of the intersection of Beltline Rd. with West 11th Ave.

5. Site History

Historically, 2-3' of fill material was deposited and spread across the site in preparation for development. In the past fifty years the site has been used for agriculture, as a parking lot, and as a storage yard.

6. Focus of Prescriptions

Restoration of wet prairie has been accomplished through a number of activities. Approximately 15,000 cubic yards of fill were removed from the site to expose the original hydric soils. Laying back the banks of Willow Creek allowed the expansion of the low flow channel and created a terraced riparian zone enhanced the riparian corridor along Willow Creek. A small backwater pond at the confluence of Willow Creek and Amazon Creek was created. The swale running west to east that conveys surface water flows from wetlands to the east of Beltline Road was widened and enhanced with willow plantings. The entire site was seeded with native wet prairie, vernal pool, emergent, and deep-water species.

7. Site-Specific Management Goals

1. Restore native wet prairie by removing fill down to the original hydric soil surface.
2. Expand the riparian zone along Willow Creek by excavating a wider channel and planting riparian vegetation.
3. Create wildlife habitat.
4. Create a narrow riparian habitat that conveys surface flows from wetlands east of Beltline Road across the site to the Willow Creek/Amazon Creek confluence, and that allows natural filtration prior to entering Willow Creek.

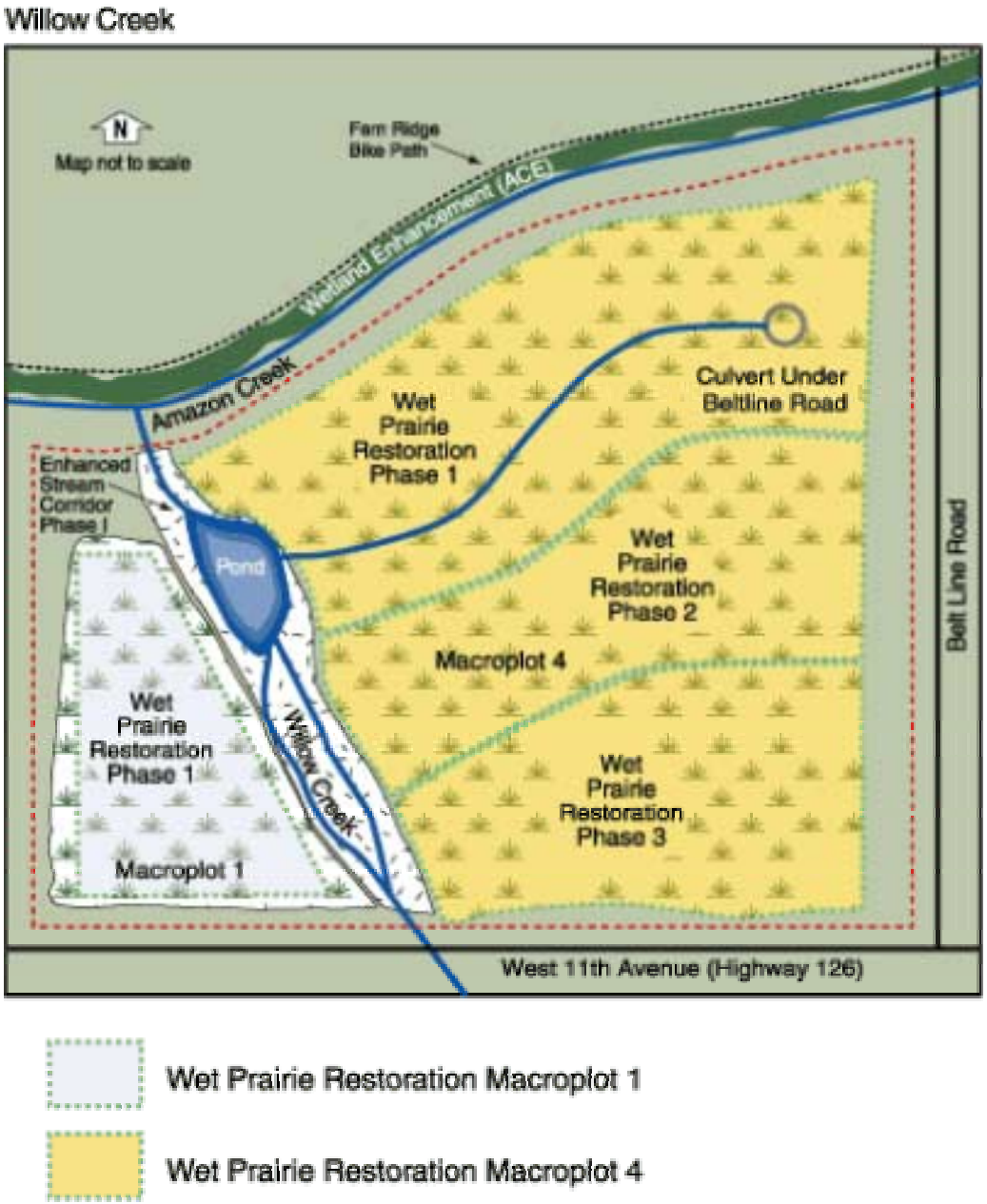


Figure 15.1. Willow Creek Confluence Site Map. All phases of the restoration for Willow Creek Confluence Unit are labeled with their associated macroplots.

B. 2002 Monitoring Summary

Monitoring at Willow Creek yielded mixed results. While hydrologic conditions continue to provide the correct environment for the development of hydric soil and hydrophytic vegetation, the establishment of wetland vegetation continues to proceed slowly in some sections, while others are almost entirely covered in monocultures of *Deschampsia cespitosa*. The percent cover of native species in the eastern macroplot is very near the 5th year target of 70%. This section was planted with plugs of several native species to increase native species cover. Aggressive weeding of the western side of Willow Creek seems to have decreased the presence of many invasive species, but quantitative monitoring will not be done again until next year. Several highly invasive species, including *Mentha pulegium, Agrostis* spp., *Circium vulgare,* and *Phalaris aquatica,* continue to cause problems on the site.

1. 2002 Management Actions

1. A maintenance crew spent one day weeding thistle and teasel from the entire site.
2. A maintenance crew spent one day weeding small patches of pennyroyal from the banks of both waterways running through the site as well as from the wet prairie on the east side of Willow Creek.
3. In the winter, 25 Sitka willow, 25 Scouler willow, 25 Pacific willow, 6 Ash, 36 Spiraea, and 15 Redosier dogwood were planted along Willow Creek and the swale that enters Willow Creek from the east. Cow parsnip seeds were also spread on the east side of Willow Creek and the south bank of the swale. The planting was done with the help of Rachel Carson High School students and Stream Team.
4. The Lane Metro Youth Corp. spent one day planting 72 nootka rose plugs (*Rosa nutkana*), 144 Bolander's rush plugs (*Juncus bolanderi*), 144 soft rush plugs (*Juncus effusus*), and 72 barestem desert-parsley plugs (*Lomatium nudicaule*). Half of the rushes and all of the rose plugs were planted along the banks of both creeks. The other halves of the rushes were planted in the vernal pools just south of the swale. The desert-parsley plugs were planted in the wet prairie just south of the swale. Most of these plugs were less than 1 inch high and had varying degrees of root development.
5. A portion of this site is also being used to test the survivability of 6 species of plugs: *Juncus nevadensis, Juncus patens, Camasia quamash ssp. maxima, Sidalcea cusickii, Lomatium nudicaule, Panicum occidentale*. Three plugs of each species were planted in 12 plots that will be monitoring for their success during the next two years.

2. Management Actions for 2003

1. The perimeter will be mowed to prevent the spread of exotics into the restoration area.
2. Pennyroyal is not yet a threat to the vernal pools but small patches do exist, so maintenance will continue to remove these patches through hand weeding.
3. The invading populations of reed canarygrass and Harding grass will be treated with a combination of cutting, solarizing, and digging as appropriate.
4. Develop strategies to contain *Agrostis* spp.
5. One area east of Willow Creek is in need of remedial action. The fill on this area appears not to have been completely removed and it has a high cover of exotic species. The area will be regraded and planted with an appropriate native seed mix.
6. Hand weed the Queen Anne's lace and false dandelion from the eastern side of Willow Creek.

Table 15.2. Progress of the Willow Confluence Unit towards meeting the MOA vegetation standards. The most recent data for each phase is compared to its relevant vegetation standards from the Bank MOA. A date in the cell indicates the year in which the data will be collected to evaluate the site's success in meeting the associated standard. 'PI' refers to point-intercept cover data collection.

Vegetation Standard in MOA	East Side of Willow Creek.	Goal Met?	West Side of Willow Creek	Goal Met?
Site status in the monitoring period	Phases 1 east, 2 & 3 in year 7, 6, & 5 (respectively) of 7	N/A	Phase 1 west in year 6 of 7	N/A
Most recent quantitative data collected in:	PI - 2002	N/A	PI - 2001	N/A
50% native **cover** after 2 years and 70% native **cover** after 5 years	69%	Yes	52%	No
75% of those species occurring at a 50% **frequency** rate or grater shall be from the Native Plant list	2004	TBD	2004	TBD
70% of the planted species shall be alive and present at the end of the five year monitoring period	41 of 68, or 60%	No	18 of 41, or 50%	No
Wet Prairie: minimum of 10 native species occurring at 10**% frequency** rate or greater	2004	TBD	2004	TBD
Emergent: min 5 native species occurring at 10**% frequency** rate or greater	2004	TBD	2004	TBD

C. Monitoring Results

1. Hydrology

a) Methods

The extent of standing water and saturated soil were estimated and mapped during site visits in the 2nd quarter (April-June) and the 4th quarter (Oct.-Dec.).

b) Results

The eastern side of Willow Creek continues to function as a mixture of vernal pool and wet prairie habitat. It contains numerous large pools (~3-10 ft. in diameter) that reach up to 4 inches deep. The western side of Willow Creek holds more water until later in the growing season. Here the pools reach up to 6 inches deep and cover the majority of the site. It functions more as a mixture of emergent wetland and vernal pool habitat. The pattern and duration of saturation and inundation observed on the site appears sufficient to support hydric soils and wetland vegetation development.

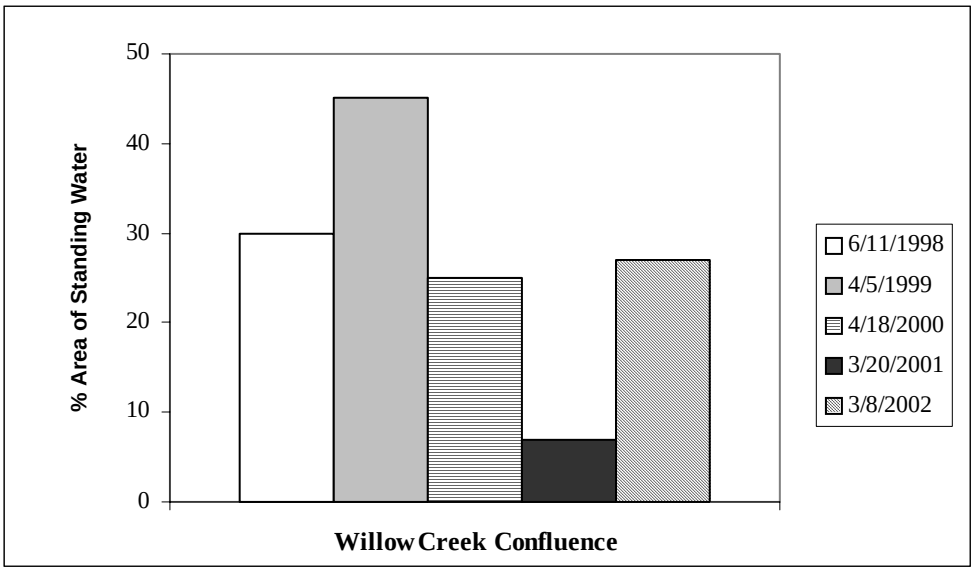


Figure 15.2. Spring standing water in the Willow Creek Confluence Unit. Percentage of the site with standing water in the early spring over the history of the restoration.

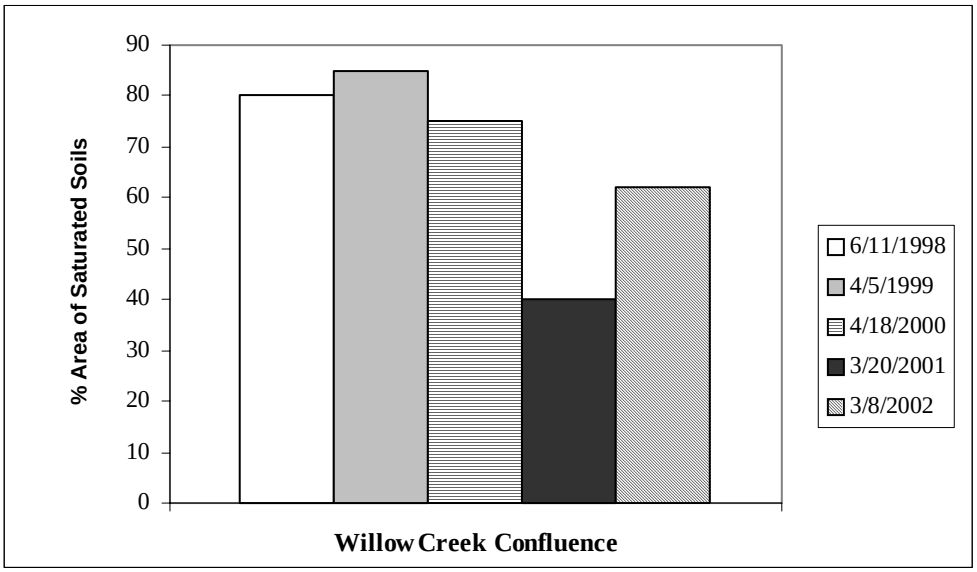


Figure 15.3. Spring saturated soils in the Willow Creek Confluence Unit. Percentage of the site with surface saturated soils in the early spring over the history of the restoration.

2. Vegetation

a) Methods

Point-intercept data were collected on June 3rd and 4th from one of the two macroplots, Macroplot 4, which covers Phases 1 East, 2, and 3. In addition, a species list was compiled for the entire site and can be viewed in Appendix B.

b) Results

The east side of Willow Creek was assessed this year using the point-intercept method. Data analysis show that 69% of the total vegetation cover was from native species, with 39% exotics. While the cover of natives comes very close to meeting the performance criteria of 70%, *Deschampsia cespitosa* alone is responsible for 32% of the native cover. *Lotus purshianus* and *Prunella vulgaris* are the next most common species, each with 2% cover. The total vegetative percent cover, the percent cover of native species, and the percent cover of introduced species all decreased from the previous year; however, none of these categories decreased significantly. The total amount of litter increased significantly from 9% to 21% cover. The only native species whose cover significantly changed was *Agrostis exarata*, with a change from 6.8% to 1.8%. This and the significant increase in litter could be a reflection of the dominance of *Deschampsia cespitosa* in this restoration. Despite the dominance of tufted hairgrass, there were a greater number of native species detected by the point-intercept method this year than in previous years. However, this is likely due to the great number of sampling points in 2001 (an increase from 200 to 400).

The overall cover of exotic species was unchanged from 2001 and the majority of these species individually did not change significantly from 2001. *Hypochaeris radicata* was the one exception, with a significant decrease (5.3% to 1.5%).

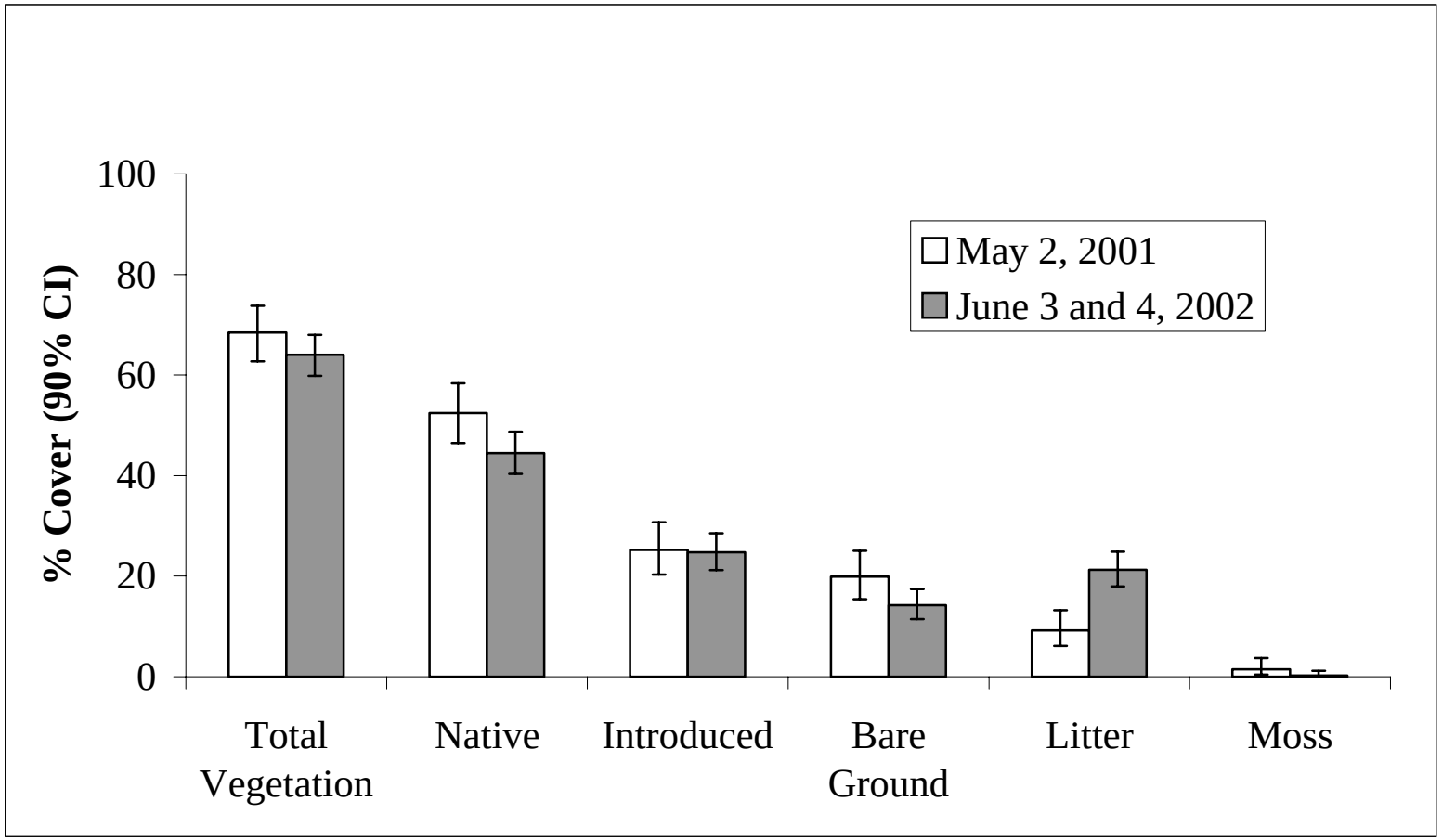


Figure 15.4. Percent cover of ground cover guilds at Willow Creek Confluence. Total percent cover, native percent cover and introduced percent covers are graphed through time for the Willow Creek Confluence Unit.

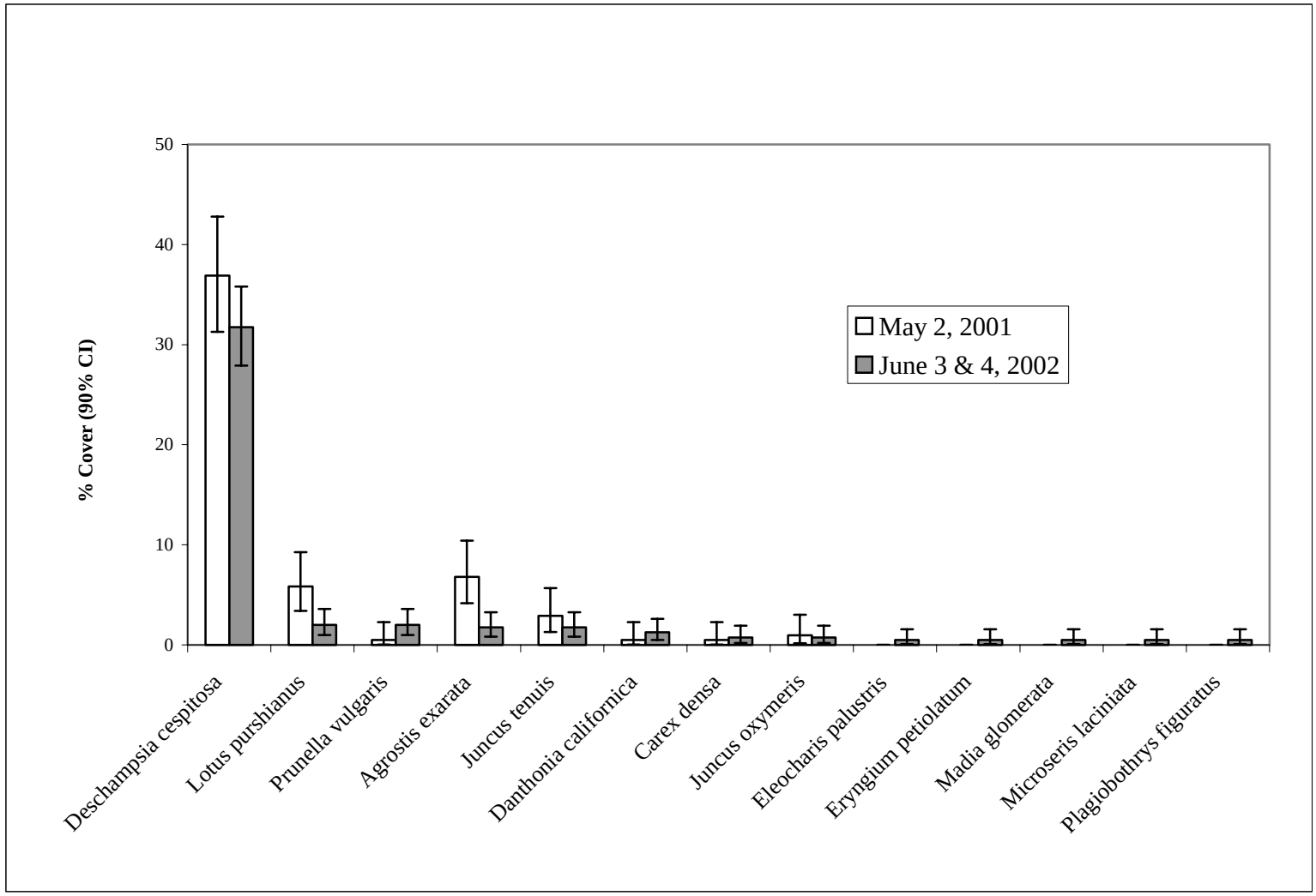


Figure 15.5. Native species on the Willow Creek Confluence Unit with > 0.5% cover. All native species in 2002 with greater than 0.5 percent cover are graphed over the history of the Willow Creek Confluence Unit restoration.

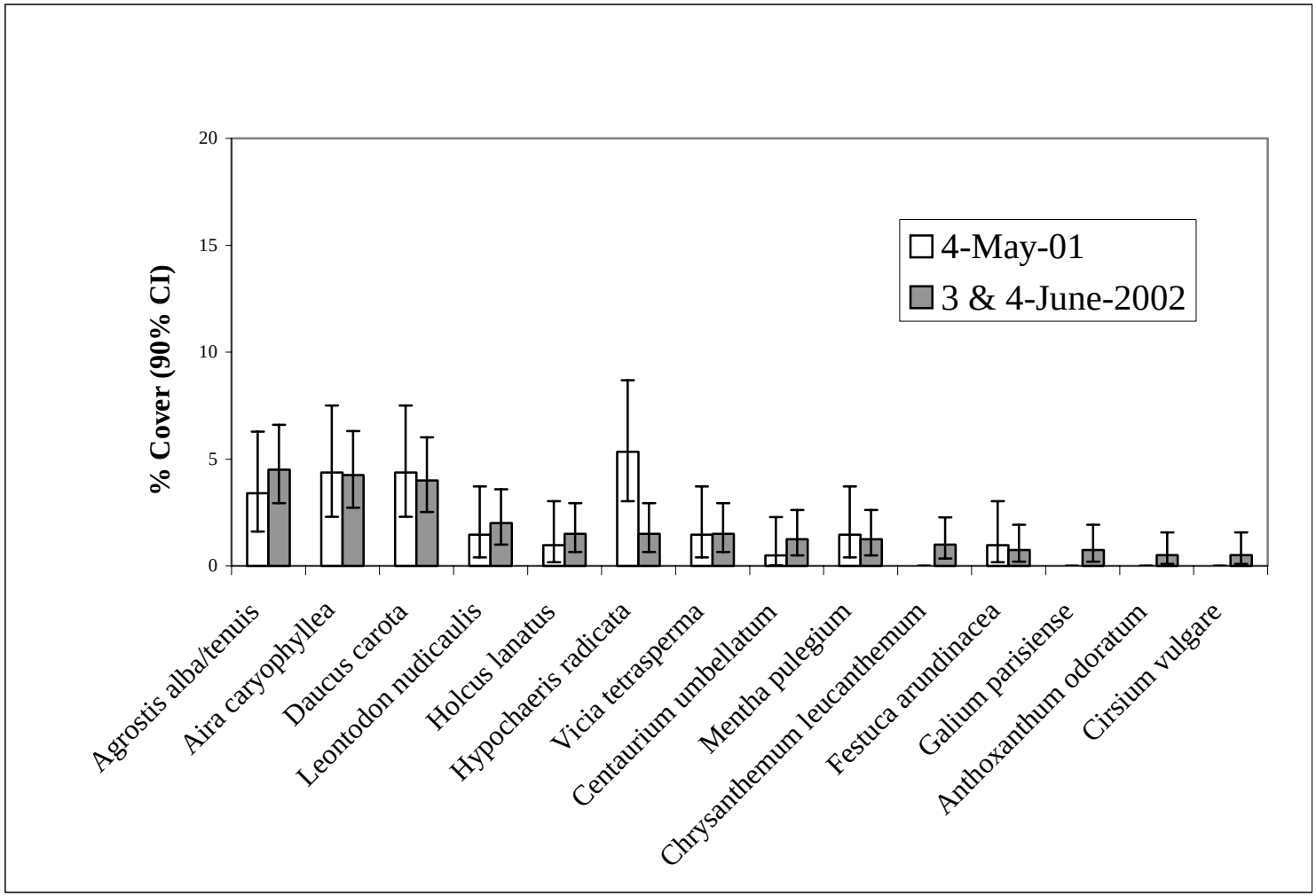


Figure 15.6. Introduced species on the Willow Creek Confluence Unit with > 0.5% cover. All introduced species in 2002 with greater than one percent cover are graphed over the history of the Willow Creek Confluence Unit restoration.

3. Wildlife Utilization

Wildlife use was similar to previous years (see 1998-2001 Annual Reports). Specific sightings for 2001 include great blue heron and mallards.

Appendix A. Monitoring Methods

Overview

A mitigation bank monitoring strategy was developed in the spring of 1997 describing mitigation goals and monitoring objectives common to all sites, site-specific goals, and monitoring objectives for existing restoration and enhancement projects. A standard field protocol for qualitative quarterly site monitoring was implemented in the fall of 1997. As new Mitigation Improvement Plans (MIPs) were written, mitigation goals and monitoring objectives were added. Improvements to the protocol were made based on field experiences in 1998. The standard plan and the protocol for quantitative vegetative monitoring were both developed in 1994 (see 1994 Annual Report for details).

A discussion of each type of monitoring is provided in the following sections.

Quarterly Monitoring

Photopoints

Purpose: Photos document surface hydrology and vegetation structure during each season, and allow comparisons between post-treatment years.

Method:

- Permanent photostations are established with metal stakes in a sufficient number to provide photo coverage of most restored and enhanced areas at all current sites.
- Photographs are taken quarterly and documented by photopoint number and compass bearing (and landmarks).

Hydrology

Purpose: Assess whether wetland hydrology is established within the restoration site. The extent of soil saturation during the growing season (March 18 – November 26) is an important factor in establishment and growth of hydrophytic vegetation.

Method:

1. Quarterly site visits during the fall, winter, and spring have included a brief description of the location, extent, and depth of standing water at each site.
2. The timing of the quarterly visits in the fall and spring should correspond with the beginning and end of the growing season, if possible.
3. The winter visit should document the maximum standing water depth and extent in emergent pools.
4. Water depth is recorded monthly beginning in October and running through May from the 1 or 2 staff gauges installed at most sites.

Vegetation Monitoring

Overall Goal: Assess the establishment of hydrophytic vegetation within restoration sites and monitor the status of hydrophytic vegetation in enhancement sites.

Species Lists

Purpose: Assess the status of each site in meeting the following Bank MOA performance standard: The standard reads that, “At least 70 percent of the planted or seeded native plants shall be present at the end of the five year monitoring period.”

Method:

1. The species list should be collected once early in the growing season (late May to mid-June) and once late in the growing season (early to mid-August).
2. A species list is compiled by thoroughly walking through a site while filling out the species checklist.

Seed Assessments
Purpose: To provide and early qualitative assessment of seeding success.
Method:
1. The assessment should take place once early in the growing season (late May to mid-June) and once late in the growing season (early to mid-August).
2. Each native species is noted, while also recording whether its presence in the restoration is 'Dominant,' 'Common,' 'Uncommon,' or present only in 'Trace' amounts."

Point-intercept Sampling
Purpose: To address the performance criteria for species importance in wetland restorations given in the MOA as: "…the restored wetland shall be dominated by native plant species where their total represents at least 50% cover after 2 years and 70% cover 5 years."
Method:
1. The area (or areas) chosen to represent the site's progress are delineated by a macroplot (or macroplots) that are sample in the 2nd and 5th years.
2. The sampling method within each macroplot is referred to as systematic sampling with a random start.
    a. The maximum point spacing is computed to fit 200 points (explained below in number 3) in each macroplot.
    b. One side of the macroplot is chosen as the baseline (X), from which transects are run at 90 degrees (Y). The location of the first transect along the baseline is chosen randomly from between 0 and 5 m, while the first sampling location along the Y axis is also selected randomly from between 0 and 4 m.
3. Each observation (or point) is obtained by lowering a vertical cylindrical metal rod with a sharp pin at the tip to note which species are covering the ground at that location.
4. The habitat type of each point is also noted (emergent, vernal pool, *Deschampsia cespitosa* dominated wet prairie, side slope, or old field).
5. The percentage of ground covered by each species is calculated by dividing the total number of observations of each plant by the total number of points. Cover estimates are given with 90% binomial confidence intervals.

Frequency Sampling
Purpose: To assess the progress of each site in meeting the Bank MOA performance standard on species type, which states that, "Of the plant species occurring at a 50% frequency rate or greater, at least 75% shall be from the Native Plant list of the West Eugene Wetlands Plan." These data are also used to assess the site's progress on the diversity and structure goals for wet prairie and emergent habitats. A minimum of 10 native species should occur at 10% frequency rate or greater in wet prairie, while a minimum of 5 native species should occur at a 10% frequency rate or greater in emergent habitats.
Method:
1. Macroplot setup and sampling are similar to the point-intercept methods; however, only 100 observations are required.
2. Each observation consists of noting the presence of each species in a 1 x 1m frame.

3. To obtain the frequency value for each species, the number of times a species is observed within the frame is divided by the total number of frames observed (100). Frequency estimates are also reported with 90% binomial confidence intervals.

Line-intercept Sampling
Purpose: To assess the progress of each site in meeting goals of woody vegetation removal for enhancement areas. For these site-specific goals, refer to the MIP for the enhancement of interest.
Method:
1. The line-intercept method is utilized for estimating the percent cover of shrubs in an enhancement area.
2. Transects are run perpendicular to the macroplot baseline. The segments of the transect that are covered by shrubsare recorded.
3. The percent cover of each shrub species is computed by dividing the length of all transects covered by that species by the combined length of all the transects.

Rare Plant Census
Purpose: To monitor the population changes of the rare and endangered species on Bank enhancement areas. Where applicable, these data will also be used to assess the effects of management actions on the populations of rare species.
Methods for *Erigeron decumbens* var. *decumbens*, *Lomatium bradshawii*, and *Horkelia congesta* ssp. *congesta*:
1. Macroplots were delineated around the entire populations of these rare species where they occur. The macroplot is divided into $1m^2$ plots, and all plots are sampled.
2. The total number of crowns (plants > 3.5 cm apart), flowers, and reproductive crowns are recorded for *Erigeron decumbens* var. *decumbens*. The total number of crowns, flowering stems per crown, and reproductive crowns are recorded for *Horkelia congesta* ssp. *congesta*. For *Lomatium bradshawii*, the total number of plants, leaves and flowering stalks are counted.

Methods for *Aster curtus*:
All populations at Oxbow West and Balboa
1. Each population is marked by a rebar placed approximately in the center of the populations.
2. The total number of ramets? is obtained by dividing the populations into sections and counting all individuals in each section.

Populations that fall within macroplots for other rare species (North Greenhill Ash Grove and Balboa)
1. The macroplot is divided into $1m^2$ plots, and all plots are sampled.
2. The presence or absence of *Aster curtus* is noted in each plot. The frequency of *Aster curtus* is obtained for each macroplot. (The total number of ramets is not obtained.)

Methods *Lupinus sulphureus* ssp. *kincaidii*:
1. Macroplots were delineated around the entire population. The macroplot is divided into $1m^2$ plots, and all plots are sampled.
2. The total number of leaves and inflorescences are tallied for the macroplot by counting them in each plot.

Wildlife Surveys
Purpose: To document wildlife usage in restoration and enhancement sites.
Method: Volunteers and the wetland staff make note of wildlife sightings as they occur.

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Acer macrophyllum	bigleaf maple	N						X												
Achillea millefolium	yarrow	N		X		X				X								X	X	
Agrostis alba/tenuis	fiorin (bentgrass)	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Agrostis exarata	spike bentgrass	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Aira caryophyllea	silver hairgrass	I	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	
Alisma lanceolatum	narrowleaf waterplantain	I	X			X		X											X	
Alisma plantago-aquatica	waterplantain	N	X	X	X	X	X	X	X	X	X	X								X
Allium amplectens	slimleaf onion	N	X	X		X	X	X		X	X	X								X
Alnus rubra	red alder	N																	X	
Alopecurus geniculatus	water foxtail	N	X			X		X	X			X					X	X	X	
Alopecurus pratensis	meadow foxtail	I	X	X	X				X	X	X	X	X	X	X	X	X	X		
Amelanchier alnifolia	western serviceberry	N	X	X		X	X			X	X								X	
Anagallis arvensis	scarlet pimpernel	I			X	X		X	X	X	X	X								
Anaphalis margaritacea	pearly-everlasting	N			X						X								X	
Anthemis cotula	mayweed chamomile	I	X		X	X				X	X	X						X	X	
Anthoxanthum odoratum	sweet vernalgrass	I	X	X		X	X	X	X	X	X	X	X	X	X	X	X			
Anthriscus caucalis	bur-chervil	I			X															
Arrhenatherum elatius	tall oatgrass	I																	X	
Aster hallii	Hall's aster	N	X	X		X	X	X	X	X	X	X	X							
Avena fatua	wild oat	I	X		X							X					X	X		
Barbarea orthoceras	wintercress	N			X				X										X	
Beckmannia syzigachne	American sloughgrass	N	X	X	X	X	X	X	X	X	X	X	X				X	X		X
Berberis aquifolium	tall Oregon grape	N			X				X											
Bidens cernua	nodding beggars-tick	N					X	X				X					X	X	X	
Bidens frondosa	leafy beggars-tick	N	X	X	X	X	X	X	X	X	X	X	X				X	X		
Boisduvalia glabella	smooth spike-primrose	N	X			X		X		X		X	X		X			X	X	
Brassica campestris	field mustard	I	X		X	X		X				X	X						X	
Briza minor	little quaking-grass	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
Brodiaea coronaria	harvest brodiaea	N		X						X									X	
Brodiaea hyacinthina	hyacinth brodiaea	N		X					X	X	X	X								X

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Bromus carinatus	California brome	N	X																X	
Bromus mollis	soft brome	I	X	X	X		X		X		X	X	X	X	X		X	X		
Bromus rigidus	ripgut brome	I										X								
Calandrinia ciliata	red maids	N											X							
Callitriche heterophylla	water starwort	N				X							X							
Callitriche stagnalis	pond water-starwort	I				X														
Camassia leichtlinii	tall camas	N		X		X				X	X							X	X	X
Camassia quamash	common camas	N	X	X		X			X	X	X		X	X	X	X		X	X	X
Cardamine oligosperma	little western bittercress	N	X	X		X						X						X		
Cardamine penduliflora	Willamette V. bittercress	N		X					X										X	
Carex densa	dense sedge	N	X	X		X	X	X	X	X	X	X	X					X		
Carex echinata	muricate sedge	N																	X	
Carex feta	green-sheath sedge	N	X	X		X	X		X	X	X	X								
Carex lanuginosa	wooly sedge	N																	X	
Carex obnupta	slough sedge	N	X	X		X											X	X		X
Carex ovalis	hare sedge	I	X	X		X	X	X	X	X							X	X		
Carex stipata	sawbeak sedge	N				X	X													
Carex tumulicola	foothill sedge	N	X																X	
Carex unilateralis	one-sided sedge	N	X	X	X	X	X	X	X		X	X	X				X	X		
Carex species	sedge	N	X		X	X			X	X		X	X					X	X	
Castilleja tenuis	hairy owl-clover	N	X	X	X			X	X			X	X	X	X	X		X		X
Centaurium muhlenbergii	monterey centaury	N	X				X		X	X	X	X	X							
Centaurium umbellatum	common centaury	I	X	X	X	X	X		X	X	X	X	X				X	X		
Centunculus minimus	chaffweed	N				X	X		X	X									X	
Cerastium viscosum	sticky chickweed	I	X	X		X		X	X			X	X	X	X		X	X		
Chamomilla suaveolens	pineapple weed	N			X								X							
Cichorium intybus	chicory	I																	X	
Cirsium arvense	Canada thistle	I	X	X	X	X	X		X	X	X	X	X		X		X	X	X	
Cirsium vulgare	bull thistle	I	X	X	X	X	X	X	X	X	X	X	X		X		X	X		

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Convolvulus arvensis	bindweed	I	X		X	X						X								
Crataegus douglasii	black hawthorn	N	X	X		X	X	X	X	X	X	X					X			
Crataegus monogyna	English hawthorn	I		X	X	X	X		X	X		X						X	X	
Crataegus douglasii X monogyna	Hybrid hawthorn	I	X	X		X		X		X		X						X		
Cuscuta sp.	dodder											X								
Cynosurus cristatus	crested dogtail	I																	X	
Cynosurus echinatus	hedgehog dogtail	I	X		X			X		X	X	X	X					X		
Cyperus acuminatus	short-pointed flatsedge	N	X		X	X	X												X	
Cyperus squarrosus	awned flatsedge	N				X													X	
Cytisus scoparius	broom	I	X	X		X	X	X	X	X	X	X					X			
Dactylis glomerata	orchard-grass	I																	X	
Danthonia californica	California oatgrass	N	X	X	X	X	X		X	X	X		X						X	
Daucus carota	Queen Anne's lace	I	X	X	X	X	X	X	X	X	X	X	X				X	X		
Delphinium menzeisii	Menzies' larkspur	N																	X	
Deschampsia cespitosa	tufted hairgrass	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Deschampsia danthonioides	annual hairgrass	N	X									X			X	X				
Deschampsia elongata	slender hairgrass	N				X									X					
Dianthus armeria	Deptford pink	**I**	X																X	
Dipsacus sylvestris	teasel	I	X	X	X	X	X	X	X	X	X	X	X				X	X	X	
Downingia elegans	showy downingia	N	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
Downingia yina	Willamette downingia	N	X					X	X	X	X	X					X	X	X	X
Echinochloa crus-galli	large barnyard-grass	I	X		X	X	X	X	X			X	X				X		X	
Eleocharis acicularis	needle spike-rush	N	X	X	X	X	X	X		X	X	X	X				X	X		
Eleocharis ovata	common spike-rush	N	X	X	X	X	X	X	X	X	X	X	X				X	X		X
Eleocharis palustris	common spikerush	N	X	X	X	X	X	X	X			X	X				X	X	X	X
Eleocharis quadrangulata	squarestem spikerush	N		X															X	
Elymus glaucus	blue wildrye	N	X		X						X		X						X	
Epilobium ciliatum	hairy willow-herb	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Epilobium densiflorum	dense spike-primrose	N	X	X		X		X	X	X	X		X		X	X	X	X	X	X
Epilobium paniculatum	autumn willow-herb	N	X	X		X	X	X	X		X	X	X	X			X	X		X

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Equisetum sp.	horsetail							X											X	
Eriophyllum lanatum	wooly sunflower	N	X	X	X	X		X		X	X	X	X		X	X			X	X
Eryngium petiolatum	coyote thistle	N	X	X	X	X		X	X	X	X	X	X					X	X	X
Festuca arundinacea	tall fescue	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Fragaria virginiana	strawberry	N		X		X						X			X	X			X	
Fraxinus latifolia	Oregon ash	N	X	X	X	X	X	X	X	X	X	X	X				X	X	X	
Galium aparine	catchweed	I										X					X	X	X	
Galium parisiense	wall bedstraw	I	X	X			X		X	X		X					X	X		
Galium trifidum	small bedstraw	N	X	X			X	X				X					X	X		
Galium triflorum	sweet scented bedstraw	N										X								
Gentiana sceptrum	staff gentian	N			X														X	
Geranium dissectum	cut-leaved geranium	I	X	X	X	X						X		X			X	X	X	
Geranium spp.	geranium	I			X				X			X								
Geum macrophyllum	Oregon avens	N				X	X												X	
Glyceria occidentalis	western mannagrass	N	X	X		X	X	X	X		X	X					X	X	X	X
Gnaphalium palustre	lowland cudweed	N	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X
Gnaphalium purpureum	purple cudweed	I	X																	
Gnaphalium uliginosum	marsh cudweed	I																	X	
Gratiola ebracteata	bractless hedge-hyssop	N	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X
Grindelia integrifolia	Willamette V. gumweed	N	X	X	X	X		X	X	X	X	X	X					X		X
Heracleum lanatum	cow parsnip	N		X		X	X	X												
Heterocodon rariflorum	heterocodon	N																	X	
Holcus lanatus	velvet grass	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hordeum brachyantherum	meadow barley	N	X		X	X		X	X	X	X	X	X		X	X	X	X	X	X
Hypericum anagalloides	bog or trailing St. John's-wort	N																	X	
Hypericum perforatum	St. John's-wort	I	X	X	X	X	X	X	X	X	X	X	X					X	X	
Hypochaeris radicata	false dandelion	I	X	X	X	X	X	X	X	X	X	X	X	X			X	X		
Isoetes nutalli	Nuttall's quillwort	N										X								

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Isoetes sp.	quillwort	N																	X	
Juncus acuminatus	tapered rush	N	X	X	X	X	X	X	X	X	X	X	X				X	X		X
Juncus articulatus	jointed rush	N	X										X						X	
Juncus bolanderi	Bolander's rush	N	X			X	X	X		X	X	X	X	X			X	X	X	X
Juncus bufonius	toad rush	N	X	X	X	X	X	X	X	X	X	X	X	X			X		X	
Juncus effusus	soft rush	N	X	X		X	X	X		X	X	X	X				X	X	X	X
Juncus ensifolius	swordleaf rush	N	X	X	X	X	X	X		X	X		X				X	X		X
Juncus marginatus	grass-leaf rush	I	X	X			X		X	X	X								X	
Juncus nevadensis	Nevada rush	N	X	X		X	X		X	X		X							X	
Juncus oxymeris	pointed rush	N	X	X	X	X	X	X	X	X	X	X						X	X	X
Juncus patens	spreading rush	N	X	X		X	X	X		X		X					X	X	X	X
Juncus tenuis	slender rush	N	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Kickxia elatine	cancerwort	I	X		X	X						X						X		
Koeleria cristata	prairie junegrass	N																	X	
Lactuca saligna	willow lettuce	I	X									X					X		X	
Lactuca serriola	prickly lettuce	I	X	X		X			X			X	X				X	X		
Lamium purpureum	red dead-nettle	I										X								
Lasthenia glaberrima	smooth lasthenia	N	X		X	X		X												X
Lathyrus aphaca	yellow vetch	I			X														X	
Lathyrus latifolius	everlasting pea	I	X																	
Lathyrus sphaericus	grass pea-vine	I	X									X			X	X				
Leersia oryzoides	cutgrass	N				X													X	
Leontodon nudicaulis	hairy hawkbit	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Lepidium sp.	peppergrass																		X	
Leucanthemum vulgare	oxeye daisy	I	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		
Lindernia anagallidea	false-pimpernel	N																	X	
Linum angustifolia	pale flax	I	X	X	X	X				X		X							X	
Lolium multiflorum	Italian ryegrass	I			X			X				X					X		X	
Lolium perenne	perennial ryegrass	I							X	X	X	X					X			
Lomatium nudicaule	barestem desert-parsley	N						X							X					

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Lonicera hispidula	hairy honeysuckle	N																	X	
Lotus corniculatus	bird'sfoot trefoil	I		X		X			X			X							X	
Lotus formosissimus	seaside lotus	N	X	X	X	X	X	X		X	X		X	X				X	X	
Lotus micranthus	small-flowered deervetch	N	X	X		X		X	X		X		X							
Lotus pinnatus	meadow deervetch	N		X						X					X				X	
Lotus purshianus	Spanish-clover	N	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X
Ludwigia palustris	water purslane	N	X	X	X	X	X	X				X	X				X		X	X
Lupinus micranthus	field lupine	N	X	X	X	X		X		X	X	X						X		X
Lupinus polyphyllus	bigleaf lupine	N							X		X	X	X							
Lupinus rivularis	stream lupine	N	X	X	X			X	X		X	X							X	
Luzula campestris	field woodrush	N	X	X		X		X		X			X		X	X				
Lysimachia nummularia	moneywort	I				X	X		X										X	
Lythrum hyssopifolia	hyssop loosestrife	I	X		X	X														
Lythrum portula	water-purslane	I	X	X	X	X	X			X		X					X	X		
Lythrum salicaria	purple loosestrife	I			X														X	
Madia elegans	showy tarweed	N				X			X	X	X							X	X	
Madia glomerata	cluster tarweed	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Madia sativa	coast tarweed	N	X	X	X	X	X	X	X	X	X	X	X	X			X	X		X
Malus fusca	western crab-apple	N	X	X		X					X	X								
Melilotus alba	white sweetclover	I				X													X	
Mentha pulegium	pennyroyal	I	X	X		X	X	X	X	X	X	X	X				X	X	X	
Mentha spicata	spearmint	I			X															
Microseris laciniata	cut-leaved microseris	N	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X
Microsteris gracilis	pink microsteris	N	X					X		X	X	X			X	X			X	X
Mimulus guttatus var. depauperatus	depauperate monkeyflower	N			X															
Moenchia erecta	moenchia	I	X	X	X							X	X	X						
Montia fontana	water chickweed	N	X		X						X									
Montia linearis	narrow-leaved montia	N	X	X	X			X	X	X	X	X	X	X					X	X
Myosotis discolor	yellow & blue forget	I	X	X		X	X	X		X	X	X	X	X	X		X			

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
	me not																			
Myosotis laxa	small-flowered forget me not	N	X	X	X	X		X				X	X				X	X	X	X
Myosotis verna		N			X															
Myosurus minimus	least mouse-tail	N															X		X	
Navarretia intertexta	needle-leaved navarrertia	N	X	X		X	X	X	X	X	X	X	X							X
Navarretia squarrosa	skunkweed	N	X			X		X			X	X								X
Nemophila parviflora	small flower nemophila	N			X															
Oenanthe sarmentosa	Pacific water-parsley	N			X														X	
Orthocarpus bracteosus	rosy owl-clover	N	X	X	X	X		X	X		X	X	X	X	X	X				X
Panicum capillare	common witchgrass	N	X	X		X							X						X	X
Panicum occidentale	western witchgrass	N	X	X		X	X	X	X	X	X		X							X
Parentucellia viscosa	yellow parentucellia	I	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X		
Perideridia oregana	Oregon yampah	N		X							X									
Perideridia gairdneri	yampah or false-carraway	N		X															X	
Phalaris aquatica	Harding grass	I	X	X			X	X	X	X		X					X	X	X	
Phalaris arundinacea	reed canarygrass	I	X	X	X	X	X	X	X	X		X					X	X		
Phleum pratense	timothy	I			X							X	X					X		
Physocarpus capitatus	Pacific ninebark	N			X														X	
Plagiobothrys figuratus	fragrant popcorn-flower	N	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X
Plagiobothrys scouleri	Scouler's popcorn-flower	N	X	X		X		X					X					X	X	
Plantago lanceolata	English plantain	I	X	X	X	X	X	X	X	X	X	X	X				X		X	
Plantago major	common plantain	I										X							X	
Plectritis congesta	rosy plectritis	N										X							X	
Poa annua	annual bluegrass	I	X		X	X					X		X	X					X	
Poa compressa	Canada bluegrass	I			X	X													X	
Poa pratensis	Kentucky bluegrass	I	X			X		X		X		X						X		

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Polygonum aviculare	doorweed	I	X					X												
Polygonum douglasii	douglas knotweed	N		X		X	X												X	
Polygonum hydropiperoides	marshpepper smartweed	N	X	X	X		X					X					X	X	X	X
Polygonum persicaria	heartweed	I	X		X	X	X	X	X			X					X		X	
Polypogon monspeliensis	rabbitfoot polypogon	I				X	X					X								
Polystichum munitum	western swordfern	N			X	X													X	
Populus trichocarpa	black cottonwood	N	X	X	X	X	X	X	X	X	X	X	X				X	X	X	
Potentilla gracilis	slender cinquefoil	N	X	X		X			X	X	X	X	X					X	X	
Prunella vulgaris	self-heal	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
Prunus sp.	"Thundercloud" plum	I								X										
Pseudotsuga menziesii	Douglas-fir	N			X	X			X											
Psilocarphus spp.	wooly heads	N			X															X
Pyrus communis	pear	I	X	X			X			X		X								
Pyrus malus	apple	I			X															
Quercus garryana	Oregon white oak	N							X	X										
Quercus kelloggii	California black oak	N			X	X	X	X	X										X	
Ranunculus alismaefolius	water-plantain buttercup	N			X															
Ranunculus aquatilis	white water buttercup	N															X	X		
Ranunculus flammula	creeping buttercup	N																	X	
Ranunculus occidentalis	western buttercup	N	X	X		X		X				X			X	X	X			X
Ranunculus orthorhynchus	straight beaked buttercup	N	X	X		X		X			X	X	X	X	X	X				X
Ranunculus repens	creeping buttercup	I			X						X	X	X							
Ranunculus sceleratus	celery-leaf butter-cup	N?			X			X												
Ranunculus uncinatus	little buttercup	N													X				X	
Rhamnus purshiana	cascara	N				X	X												X	
Rorippa curvisiliqua	western yellowcress	N	X			X	X	X	X	X	X	X	X				X	X		X
Rorippa nasturtium-aquaticum	watercress	N			X								X							
Rosa eglanteria	sweetbriar	I	X	X		X	X			X									X	

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

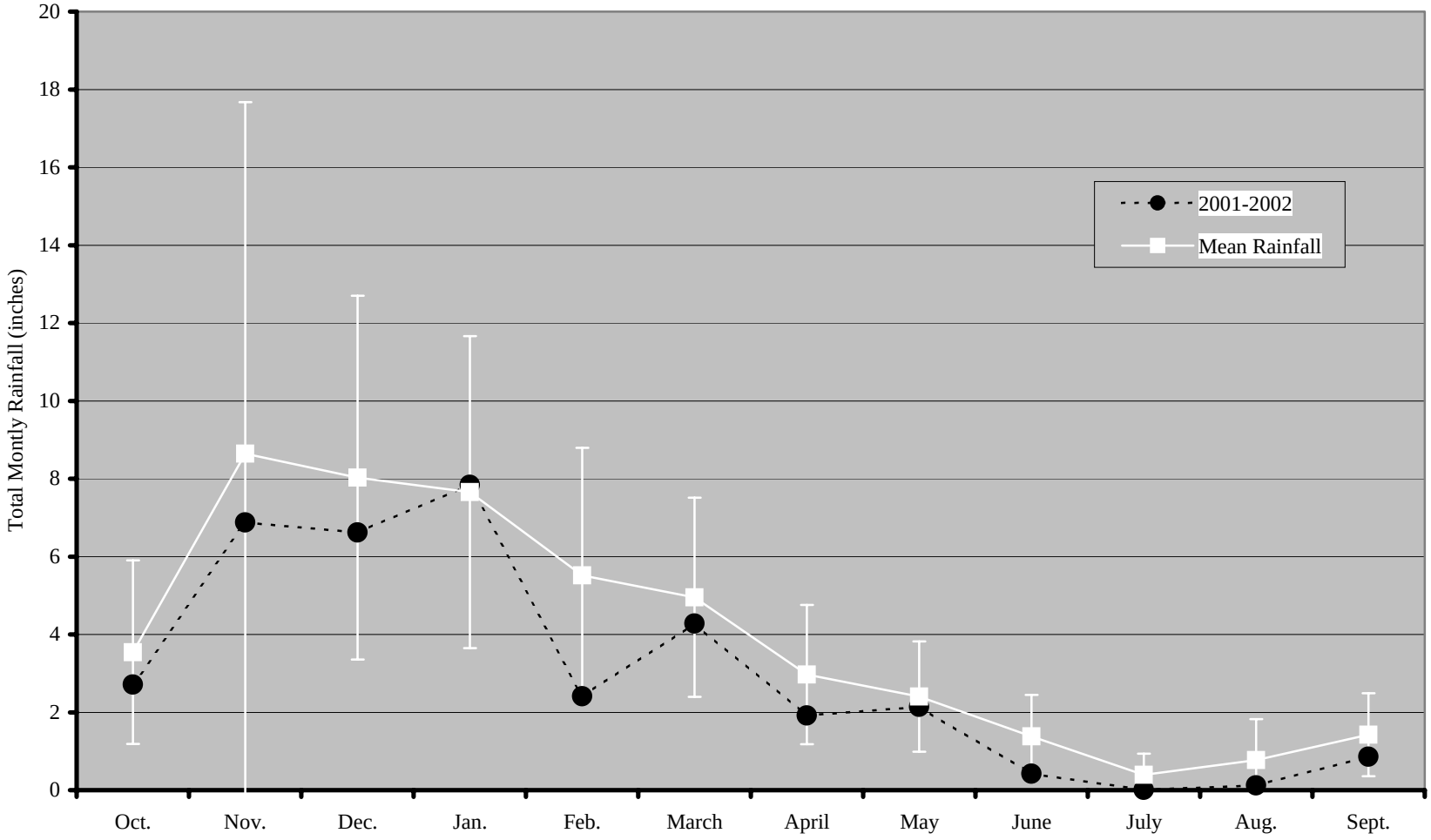
Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Rosa multiflora	many flowered rose	I	X	X	X	X	X		X	X		X	X					X	X	
Rosa nutkana	Nootka rose	N	X	X		X	X	X	X	X	X	X	X					X		
Rosa pisocarpa	peafruit rose	I															X		X	
Rubus discolor	Himalayan blackberry	I	X	X	X	X	X	X	X	X	X	X	X				X	X		
Rubus laciniatus	evergreen blackberry	I	X	X	X	X	X			X		X								
Rubus ursinus	Pacific blackberry	N		X				X											X	
Rumex acetocella	sheep sorrel	I	X	X		X	X	X	X	X	X	X	X							
Rumex conglomeratus	clustered dock	I	X																X	
Rumex crispus	curly dock	I	X	X		X	X	X	X	X		X	X				X	X	X	
Rumex salicifolius	willow dock	N	X			X		X	X			X	X					X		X
Salix geyeriana	Geyer willow	N			X														X	
Salix hookeriana	Hooker willow	N																	X	
Salix lasiandra	Pacific willow	N										X								
Salix piperi	Piper's willow	N					X					X							X	
Salix scouleriana	Scouler willow	N			X	X		X											X	
Salix sessilifolia	Northwest willow	N			X														X	
Salix sitchensis	Sitka willow	N				X					X	X								
Salix sp.	willow		X			X											X	X	X	
Sanicula sp.	sanicle		X		X			X	X											
Sanquisorba occidentalis	annual burnet	N				X													X	
Saxifraga oregana	bog saxifrage	N	X	X					X	X										
Saxifraga integrifolia	swamp saxifrage	N			X															
Scirpus americanus	bulrush	N			X		X													
Scirpus microcarpus	small-fruited bulrush	N			X														X	
Scirpus tabernaemontani	softstem bulrush	N					X			X									X	X
Senecio jacobea	tansy ragwort	I	X	X	X	X	X		X	X	X	X	X		X	X		X		
Senecio sylvaticus	wood groundsel	I			X							X					X		X	
Senecio vulgaris	old-man-in-the-spring	I	X			X							X							
Sherardia arvensis	blue field-madder	I										X								
Sidalcea campestris	meadow sidalcea	N	X			X							X						X	

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Sidalcea virgata	rose checker-mallow	N											X							
Sisyrinchium californicum	golden-eyed grass	I				X													X	
Sisyrinchium idahoense	Idaho blue-eyed grass	N	X	X		X			X	X	X		X					X		X
Sisyrinchium hitchcockii	Hitchcock's blue-eyed grass	N						X	X											
Sitanion hystrix	squirrel-tail bottlebursh	N										X		X						
Solanum dulcamara	climbing nightshade	I	X			X											X		X	
Solidago canadensis	Canada goldenrod	N		X															X	
Sonchus asper	prickly sow-thistle	I	X	X		X	X		X	X	X	X	X				X	X	X	
Sorghum halapense	Johnson grass	I						X												
Sparganium emersum	simplestem bur-reed	N																	X	
Spergula arvensis	stickwort	I		X						X	X									
Spergularia rubra	red sandspurry	I	X								X								X	
Spiraea douglasii	Douglas spirea	N	X	X		X					X									
Spiranthes romanzoffiana	ladies-tresses	N						X		X								X		
Stellaria media	chickweed	I				X													X	
Taraxicum officinale	dandelion	I					X													
Toxicodendron diversiloba	poison oak	N		X		X				X										
Trichostema lanceolatum	vinegar weed	N																	X	
Trifolium dubium	least hop clover	I	X	X		X			X	X		X		X	X	X		X	X	
Trifolium hybridum	hybrid clover	I	X			X	X	X	X			X							X	
Trifolium pratense	red clover	I	X					X				X						X	X	
Trifolium repens	white clover	I																X		
Trifolium subterraneum	subterranean clover	I	X					X	X											
Trifolium variegatum	white-tip clover	N																	X	
Typha latifolia	cat-tail	N	X	X	X	X	X					X							X	
Verbascum blattaria	moth mullein	I				X													X	
Verbascum thapsus	common mullein	I										X							X	
Veronica americana	American speedwell	N	X			X												X		X
Veronica arvensis	wall speedwell	I			X								X						X	

Appendix B. Species Lists for all Mitigation Bank Sites. The species observed on each site are recorded by noting the section of the restoration or enhancement area in which they were found.

Scientific Name	Common Name	Origin	Balboa			Beaver Run			Danebo	Isabelle		Nolan	North Greenhill Prairie				Stewart Pond		Willow Creek	Turtle Swale
			R1&2	E	A/P	R1	E	R2	R	E	R	R	R1	S1	R2	S2	Pond	R	R	R1
Veronica peregrina	purslane speedwell	N	X		X	X						X	X					X	X	X
Veronica scutellata	marsh speedwell	N	X	X	X	X	X	X	X	X	X	X	X				X	X		X
Viburnum ellipticum	Oregon viburnum	N						X											X	
Vicia cracca	bird vetch	I	X	X	X				X			X			X	X			X	
Vicia hirsuta	hairy vetch	I	X	X		X		X				X						X		
Vicia sativa	common vetch	I	X	X	X	X		X	X	X	X	X				X		X	X	
Vicia tetrasperma	slender vetch	I	X	X	X	X	X	X	X	X		X	X				X	X		
Vulpia bromoides	barren fescue	I	X		X	X		X			X									
Vulpia myuros	rat-tail fescue	I										X								
Vulpia sp. (annual)	annual fescue	I											X						X	
Wyethia angustifolia	narrow-leaf mule's ears	N		X					X		X									
Zigadenus venenosus	death camas	N		X																



Appendix C. Monthly rainfall totals for Eugene Airport during 2001-2002 compared to the mean and standard deviation of monthly rainfall between 1940 and 2002.